FOREST SERVICE ROADLESS AREA CONSERVATION FINAL ENVIRONMENTAL IMPACT STATEMENT

BIOLOGICAL EVALUATION

FOR

THREATENED, ENDANGERED AND PROPOSED SPECIES

AND

SENSITIVE SPECIES

November 2000
(Amended)

After a thorough review, we have determined that all of the alternatives analyzed for this biological evaluation have the same overall determination of potential effects to threatened, endangered, and proposed species, and designated and proposed critical habitat. It is our determination that:

> *The alternatives analyzed in this biological evaluation may affect, but are not likely to adversely affect threatened or endangered species or adversely modify designated critical habitat, and are not likely to jeopardize proposed species or adversely modify proposed critical habitat. Furthermore, these alternatives may beneficially affect threatened, endangered, and proposed species and critical habitat.*

We have further determined for Regional Forester designated sensitive species that:

> *The alternatives analyzed in this biological evaluation may impact individuals, but are not likely to cause a trend towards federal listing or a loss of viability for any sensitive species. Furthermore, these alternatives may beneficially impact sensitive species and their habitats.*

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DATE **11/13/2000**

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Overview

The Forest Service is evaluating possible road construction, reconstruction, and timber harvest restrictions in inventoried roadless areas. Given circumstances unique to the Tongass National Forest, the agency is considering that forest under a separate set of alternatives.

This proposal is not a "major construction" activity, as defined in the implementing regulations for the Endangered Species Act (ESA) at 50 CFR 402.02. It would not, in itself, result in any ground disturbing activities. The action alternatives would not mandate specific project activities, but they would have implications for threatened, endangered, proposed and sensitive species management and conservation.

This biological evaluation (BE) assesses the potential effects to threatened, endangered, proposed, and sensitive (TEPS) species from all of the action alternatives. All of the alternatives analyzed for this biological evaluation were found to have the same overall determination of effects:

> *The alternatives analyzed in the biological evaluation:*
>
> - *may affect, but are not likely to adversely affect threatened or endangered species or adversely modify designated critical habitat, and are not likely to jeopardize proposed species or adversely modify proposed critical habitat. Furthermore, these alternatives may beneficially affect threatened, endangered, and proposed species and critical habitat.*
>
> - *may impact individuals, but are not likely to cause a trend towards federal listing or a loss of viability for any sensitive species. Furthermore, these alternatives may beneficially affect sensitive species and their habitat.*

All of the action alternatives would have the potential for important beneficial impacts to TEPS species, by reducing risks of future habitat degradation and disturbance, and conserving existing biological strongholds. The degree of beneficial effects would vary by alternative.

This biological evaluation amends and replaces the two previous BE's on the DEIS alternatives, dated July 31, 2000 for TEP species, and August 25, 2000 for sensitive species. This combined and amended BE was completed to address changes in alternatives and data updates between issuance of the draft and final environmental impact statements. Some of the key changes include:

- Identification of a new preferred alternative;
- Consideration of additional social and economic mitigation measures;

- Removal of the procedural alternatives, as this aspect is covered under the new planning regulations (36 CFR 219);
- Restructuring the Tongass alternatives to reflect removal of the procedures and clarification of the no action and not exempt alternatives.
- Clarification the types of harvest that would be permitted under the stewardship provision of Alternative 3.
- Application of the alternatives to all parts of inventoried roadless areas, including those areas previously roaded;
- Inclusion of those inventoried roadless areas which are also Special Designated Areas;
- Minor updates to species lists; and
- Minor changes in maps and acreages.

1.0 INTRODUCTION

Given the importance of roadless areas for watershed and ecosystem health and the controversy surrounding the management of roadless areas, the Forest Service has determined that there is a need for national level direction. The purpose of this action is to immediately stop activities that have the greatest likelihood of degrading desirable characteristics of inventoried roadless areas while considering the unique social and economic situation of the Tongass National Forest.

This biological evaluation (BE) follows direction established in the Forest Service Manual (FSM 2672.42), (USDA 1990). Both the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) have been involved in the development and evaluation of alternatives. These agencies have advised the Forest Service that a biological assessment is not required for consultation, as this proposal is not a "major construction activity" as defined in the implementing regulations for the Endangered Species Act at 50 CFR 402.02. As required by 50 CFR 402.14(c), all pertinent and necessary supporting documentation, including this BE, is being submitted to NMFS and USFWS as part of consultation prior to completion and publication of a final rule.

The action alternatives would not authorize specific land use activities but rather would apply restrictions to inventoried roadless areas on road construction and reconstruction, as well as on some or all timber harvest under Alternatives 3 and 4, respectively. The Tongass alternatives would consider and if, where, and when to apply prohibitions.

The level of analysis in this BE is commensurate with the national scale and non-ground disturbing nature of the action alternatives. The BE does not take the place of site-specific, project-level planning, and analysis for future activities in these areas.

The action alternatives would involve 38 States (see FEIS Volume 2 - Maps of Inventoried Roadless Areas) affecting all nine Forest Service Regions, and 120 National

Forests and Grasslands. There are approximately 58.5 million acres of inventoried roadless areas in the National Forest System, representing about 2% of the lands in the United States, and 31% of NFS lands. This includes approximately 9.3 million acres of inventoried roadless areas on the Tongass NF. Because some areas currently have management prescriptions that allow road building, roads have been constructed in approximately 2.8 million acres since the inventory boundaries were updated.

There are approximately 400 threatened, endangered and proposed (TEP) species, 44 candidate species, and 2,930 sensitive species within the nine Forest Service Regions. Inventoried roadless areas provide habitat or affect habitat for an estimated 220 TEP and 1,930 sensitive species. Forty-four species have designated critical habitat within inventoried roadless areas. Complete lists of these species are included in Attachments TEP1 and S1. Candidate species are listed in Attachment TEP2.

2.0 Background

Inventoried roadless areas provide or affect habitat for over 55% of the TEP species found on or affected by NFS lands, representing approximately 25% of all animal species and 13% of all plant species listed under the Endangered Species Act within the United States. In addition, these areas affect over 65% of Forest Service designated sensitive species. TEPS species are found in all Forest Service Regions, as shown in Attachments TEP1 and S1.

These statistics suggest the important role that inventoried roadless areas currently play, both individually and cumulatively, in maintaining species viability and native biodiversity. It is likely that some of these inventoried roadless areas are relatively much more important now than in the past, due to cumulative degradation and loss of other, potentially more biologically rich habitat in adjacent landscapes. With extinction risk for many species directly correlated to habitat loss and degradation, (Stein and Flack 1997), these numbers give an indication of what may be at risk if the relatively undisturbed habitat provided by these areas is not maintained.

Wilcove and others (2000) examined available information for 1880 imperiled and listed species, and determined that habitat destruction and degradation contributed to the endangerment of 85% of those species. Other important contributing factors included competition with or predation by non-native species (49% of species), pollution (24% of species), and overexploitation (17% of species). Even though the numbers vary between species group and parts of the country, nationally these inventoried roadless areas play an important role in providing habitat for a substantial number of TEPS species.

The worldwide rate of extinction has been estimated to be approximately 400 times that of recent geologic time, and is increasing (Wilson 1985). Based on estimates made by the Nature Conservancy (Stein and Flack 1997), at least 110 species of plants and animals are known to be extinct in the United States, and an additional 416 species are possibly extinct, with no recent documented occurrences. They estimate that about one-third of U.S. plant and animal species have an increased risk of extinction. It is conceivable that the number of species in the United States that merit listing early in the 21st century may be 2 or 3 times that of the number currently listed (Wisdom and others 1999). These statistics indicate the importance of conserving some of the remaining relatively undisturbed, large blocks of habitat for those species whose continued viability may be at risk.

3.0 Action Alternatives

The deciding official will make three decisions relative to roadless area conservation:

1. Should road construction and reconstruction, and some or all timber harvest be prohibited in inventoried roadless areas?
2. Should the prohibition alternative selected be applied to the Tongass National Forest or modified to meet the unique situation on the Tongass?
3. What social and economic mitigation measures should be applied to the selected alternatives?

The FEIS describes two sets of alternatives: 1) four alternatives, including a No Action Alternative, that cover the range of possible prohibited activities in inventoried roadless areas consistent with the stated purpose and need; and 2) four alternative ways to apply the prohibitions to the Tongass National Forest. For a full description of each alternative, see Chapter 2 of the FEIS. A summary description is included here. Each set of action alternatives is accompanied by a no action alternative that represents no change from current policy. The no action alternative provides a baseline for comparing the effects of the action alternatives.

The Agency also developed a third set of alternatives in the DEIS (procedural Alternatives A through D). Analysis of comments on the DEIS for the Roadless Rule showed that there was confusion about how the procedural alternatives would be implemented. Public comments on the proposed Planning Regulations and Agency comments on the DEIS for the Roadless Rule also suggested that the procedures for roadless area protection were best suited for the Planning Regulations. Upon review, most of the roadless characteristics identified in the DEIS and proposed Roadless Rule were similarly required by the Planning Regulations. Therefore, the Forest Service determined that the procedures contemplated in the Roadless Rule should be an explicit part of the plan revision process, and addressed them at 36 CFR 219.9(b)(8) of the final Planning Regulations. By making small changes to the Planning Regulations, the procedural alternatives discussed in the DEIS were not needed as a part of the Roadless Rule and were removed from the FEIS.

In the Record of Decision and final rule, the responsible official will select one prohibition alternative and one Tongass alternative. If the responsible official chooses to treat the Tongass the same as every other national forest, the official would select the alternative that does not exempt the Tongass (Tongass Not Exempt). If the decision is to treat the Tongass differently than other national forests, one of the other Tongass alternatives would be chosen. Mitigation measures have also been identified that could be used to reduce economic and social impacts of the various alternatives. Any of these mitigation measures could be chosen to mitigate the effects of the selected alternative.

The following provisions would apply to any alternative selected in the Record of Decision and documented in the final rule:

- The rule would not suspend or modify any existing permit, contract, or other legal instrument authorizing the occupancy and use of National Forest System land;
- The rule would not compel the amendment or revision of any land and resource management plan; and
- The rule would not suspend or modify any project or activity decision made before the effective date of the final rule.

Exceptions Common to All Action Alternatives

The following exceptions were developed in part from public comments received on the Notice of Intent and were used in Alternatives 2 through 4 in the DEIS. These exceptions have been incorporated into the FEIS without substantive change. Based on comments from the U.S. Fish and Wildlife Service and National Marine Fisheries Service, an additional exception has been added to Alternative 4 that would apply if that prohibition alternative is selected.

In all action alternatives, including the Tongass alternatives, the responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, Section 311 of the Clean Water Act, or the Oil Pollution Act;
- A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; or
- Realignment is needed to prevent irreparable resource damage by a classified road. The road must be deemed essential for public or private access, natural resource management, or public health and safety, and the resource damage associated with the road cannot be corrected by maintenance.

The effects of the prohibition and Tongass alternatives, their combined effects, and potential mitigation measures, are described in Chapter 3 of the FEIS. In that analysis and in the comparison tables in that same chapter, the above exceptions common to all action alternatives are included in Alternatives 2 through 4. Other exceptions that were developed as social and economic mitigation measures are evaluated as separate components that can be added to each alternative.

Prohibition Alternatives

The following alternatives describe the activities that would not be allowed on approximately 58.5 million acres of inventoried roadless areas (49.2 million acres if the Tongass National Forest is not included in the final rule), identified in the FEIS Volume 2 maps. As described in Chapter 1 of the FEIS, the Agency determined the scope of this analysis should consider national prohibitions against road construction, road reconstruction, and timber harvest.

Depending on which alternative is selected, the prohibitions would apply to the entire area within the boundaries of inventoried roadless areas, including portions that contain existing roads.[1] Some projects or activities may be allowed within those boundaries, if they qualify under one of the exceptions described previously.

Alternative 1
No Action; No Prohibitions

Alternative 2
Prohibit Road Construction and Reconstruction Within Inventoried Roadless Areas

Alternative 3
Prohibit Road Construction, Reconstruction, and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas

Alternative 4
Prohibit Road Construction, Reconstruction and All Timber Cutting Within Inventoried Roadless Areas

Alternative 1
No Action; No Prohibitions

No rule prohibiting activities in inventoried roadless areas would be issued. Road construction and reconstruction would continue to be restricted only where land management plan prescriptions prohibit such action (approximately 24.2 million acres), unless land allocations and management prescriptions for these areas are changed during future plan revisions. Future proposals for road construction and reconstruction, where

[1] As described in the DEIS, the prohibition alternatives would have applied to the "unroaded portion of an inventoried roadless area." Public comments indicated that this concept was confusing and would be difficult to apply and administer consistently. The effects analysis in the DEIS was actually based on application of the prohibitions to entire inventoried roadless areas, since data were not specific to roaded or unroaded portions. Therefore, both the concept and the definition of "unroaded portion" were deleted from the alternatives and analysis in the FEIS and this biological evaluation.

allowed by current land management plans, would be considered on a case-by-case basis at the project level with public comment and following the requirements of the National Environmental Policy Act (NEPA). There would be no restrictions on timber harvest under this alternative.

Both even-aged and uneven-aged silviculture management could be used if needed and allowed by the existing land management plans. Precommercial thinning, commercial thinning, and regeneration harvest, as well as the harvest of trees damaged by fire, insects, disease, or other natural disturbance, could be used to achieve both even- and uneven-aged forest stands when consistent with other resource needs. Logging is likely to include the use of ground-based equipment (for example, tractors and forwarders), cable systems, and helicopter.

In addition to meeting NEPA requirements for considering the effects of no action, this alternative also establishes a benchmark against which the effects of the other alternatives are compared.

Alternative 2

Prohibit Road Construction and
Reconstruction Within Inventoried Roadless Areas

Road construction and reconstruction, including temporary road construction, would be prohibited in inventoried roadless areas upon implementation of the final rule. There would be no restrictions on timber harvest under this alternative. Road reconstruction activities are those that result in realignment or improvement of an existing road. Examples of prohibited reconstruction activities include, but are not limited to:

- Improving a road to increase its capacity (for example, number of lanes, higher speeds, number of vehicles);
- Improving a road to change the original design function (for example, from fire access to developed recreation site access);
- Increasing the traffic-service level (for example, from use by high clearance pickups to low clearance passenger cars); and
- Realigning an existing road to a new location.

Both even-aged and uneven-aged silviculture management could be used if needed and allowed by the existing land management plans. Precommercial and commercial thinning, and regeneration harvest, as well as the harvest of trees damaged by fire, insects, disease, or other natural disturbance, could be used to achieve both even- and uneven-aged forest stands when consistent with other resource needs. Logging is likely to include the use of ground-based equipment (for example, tractors and forwarders), cable systems, and helicopter. Road construction and reconstruction in support of these activities would be prohibited in inventoried roadless areas.

Alternative 3

*Prohibit Road Construction, Reconstruction,
and Timber Harvest Except for Stewardship
Purposes Within Inventoried Roadless Areas*

Road construction and reconstruction, including temporary road construction, would be prohibited in inventoried roadless areas upon implementation of the final rule. Road reconstruction activities are those that result in realignment or improvement of an existing road. Examples of prohibited reconstruction activities include, but are not limited to:

- Improving a road to increase its capacity (for example, number of lanes, higher speeds, number of vehicles);
- Improving a road to change the original design function (for example, from fire access to developed recreation site access);
- Increasing the traffic-service level (for example, from use by high clearance pickups to low clearance passenger cars); and
- Realigning an existing road to a new location.

Timber harvest would be prohibited except for stewardship purposes. Stewardship purpose timber harvest can only be used where it maintains or improves roadless characteristics and:

- Improves threatened, endangered, proposed or sensitive species habitat;
- Reduces the risk of uncharacteristically intense fire; or
- Restores ecological structure, function, processes, or composition.

Logging for stewardship purposes is likely to include the use of ground-based equipment (for example, tractors and forwarders), cable systems, and helicopter. Road construction and reconstruction in support of these activities would be prohibited in inventoried roadless areas.

Personal-use harvest, including firewood and Christmas trees, would be permitted. Tree cutting could occur incidental to other management activities, such as trail construction or maintenance, removal of hazard trees adjacent to classified roads for public health and safety reasons, fire line construction for wildland fire suppression or control of prescribed fire, or survey and maintenance of property boundaries. Mechanical fuel treatments, such as crushing, piling, or limbing, would be permitted.

Alternative 4

*Prohibit Road Construction, Reconstruction and
All Timber Cutting Within Inventoried Roadless Areas*

Road construction and reconstruction, including temporary road construction, would be prohibited in inventoried roadless areas upon implementation of the final rule. Road reconstruction activities are those that result in realignment or improvement of an existing road. Examples of prohibited reconstruction activities include, but are not limited to:

- Improving a road to increase its capacity (for example, number of lanes, higher speeds, number of vehicles);
- Improving a road to change the original design function (for example, from fire access to developed recreation site access);
- Increasing the traffic-service level (for example, from use by high clearance pickups to low clearance passenger cars); and
- Realigning an existing road to a new location.

Timber cutting would be prohibited for both commodity and stewardship purposes. Personal-use harvest, including firewood and Christmas trees, would be permitted. Limited tree cutting could occur incidental to other management activities, such as trail construction or maintenance, hazard tree removal adjacent to classified roads for public health and safety reasons, fire line construction for wildland fire suppression or control of prescribed fire, or survey and maintenance of property boundaries. Mechanical fuel treatments, such as crushing, piling, or limbing, would be permitted, but under this alternative, area-wide tree cutting for fuel reduction purposes would be prohibited. Road construction and reconstruction in support of these activities would be prohibited in inventoried roadless areas.

The responsible official may authorize an exception to the prohibition on timber harvest if it is determined that such harvest is necessary: 1) to prevent degradation or loss of habitat, to the extent that such loss or degradation would increase the risk of extinction for a threatened or endangered species, or for a species that has been proposed for listing as threatened or endangered under the Endangered Species Act; or 2) to promote recovery of a threatened or endangered species. In all cases, agreement that the proposed action is warranted must be obtained from the National Marine Fisheries Service or United States Fish and Wildlife Service, as applicable.

Social and Economic Mitigation Measures

Several new exceptions were developed as the result of public comment on the DEIS. While similar to the exceptions proposed in the DEIS, their purpose is to mitigate some potential social and economic impacts the various alternatives may cause. The final rule may or may not include some or all of these mitigation measures. An analysis of their effects is included in Chapter 3 of the FEIS.

These exceptions could be applied to any of the action alternatives. The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- Reconstruction is needed to implement road safety improvement projects on roads determined to be hazardous on the basis of accident experience or accident potential;
- The Secretary of Agriculture determines that a Federal Aid Highway project authorized pursuant to Title 23 of the United States Code is in the public interest or is consistent with the purposes for which the land was reserved or acquired, and no other feasible alternative exists; or
- A road is needed for prospective mineral leasing activities in inventoried roadless areas.

The first exception was added to allow for the realignment or improvement of roads in situations where the current location or design is unsafe. For example, if there is an unsafe hairpin turn on a road which connects two communities, the road can be realigned to eliminate the unsafe hairpin turn. The second exception was added in response comments regarding the effects this rule could have on State highway projects proposed as part of the National Highway System. Under current regulations, State highway projects on NFS lands have to be approved by the Secretary of Agriculture. This exception maintains the Secretary's discretion as it already exists. The third exception was added in response to comments regarding the impacts the prohibition on road construction may have on future mineral leasing.

In conjunction with, but independent of this rule, the Chief of the Forest Service intends to work with affected States and communities and to pursue funds to help them respond to economic changes that may result from implementation of the final Roadless Rule.

In all action alternatives the Chief of the Forest Service may implement one or more of the following provisions of an economic transition program for communities most affected by changes in management of inventoried roadless areas:

- Provide financial assistance to stimulate community-led transition programs and projects in communities most affected by changes in roadless area management;
- Through financial support and action plans, attract public and private interest, both financial and technical, to aid in successfully implementing local transition projects and plans by coordinating with other Federal and State agencies; and
- Assist local, State, Tribal and Federal partners to work with those communities most affected by the final roadless area decision.

Tongass National Forest Alternatives

The following alternatives describe four alternative ways to apply the prohibition alternatives to the Tongass National Forest:

Tongass Not Exempt

Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest

Tongass Exempt

Alternative Selected for the Rest of National Forest System Lands Would Not Apply to the Tongass National Forest

Tongass Deferred

No Alternative Selected at This Time; Determine Whether Road Construction Should be Prohibited in Inventoried Roadless Areas on the Tongass as Part of the 5-Year Plan Review

Tongass Selected Areas

Prohibit Road Construction and Reconstruction in Old Growth, Semi-Remote Recreation, Remote Recreation Land Use Designations, and LUD IIs within Inventoried Roadless Areas on the Tongass

Alternatives T1 and T4 in the DEIS have been renamed (Tongass Exempt and Tongass Selected Areas, respectively), and incorporated without any substantive change into this FEIS. Because of the decision to include the procedures in the final Planning Regulations, the other Tongass alternatives (T2 and T3) have been modified from their original form in the DEIS, combined and redescribed as Tongass Deferred. In addition, an alternative named Tongass Not Exempt has been added to describe the decision maker's option of applying the selected prohibition alternative to the Tongass without any modification. This alternative (Tongass Not Exempt) includes an optional economic mitigation measure that would delay implementation of the prohibition alternatives on the Tongass until 2004.

Tongass Not Exempt

Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest

This alternative is intended to clarify that under prohibition Alternatives 2 through 4, the Tongass would be treated the same as all other forests in the National Forest System. It is not a new alternative, but a clarified and reformatted description of an action that was implied on page 2-10 of the DEIS. Public comment showed some confusion about the intended incremental effects of applying the prohibitions to the Tongass. Under this alternative, the inventoried roadless areas on the Tongass would not be exempt from the prohibitions selected in the final rule.

Also as the result of public comment on the DEIS, the following optional mitigation measure was developed for this alternative. This delay in implementation would allow communities most affected by the final roadless area decision to adjust to changes in management of inventoried roadless areas.

In Tongass Not Exempt, the final rule may include the following social and economic mitigation measure to provide a transition period for communities most affected by changes in management of inventoried roadless areas:

- If this mitigation is included in the final rule, the prohibition alternative selected for inventoried roadless areas on all other NFS lands would be applied to inventoried roadless areas on the Tongass in April 2004.

Tongass Exempt

Alternative Selected for the Rest of National Forest System Lands Would Not Apply to the Tongass National Forest

This alternative was labeled Alternative T1 in the DEIS. Under this alternative, the Tongass National Forest would be exempt from the prohibitions in the final Roadless Rule. Future proposals for road construction and reconstruction would be considered on a case-by-case basis where allowed by the current land management plan, with roadless characteristics and values analyzed at the project level and raised as an issue. Under this alternative, land management would continue as outlined in the April 1999 Record of Decision for the Tongass Land and Resource Management Plan (TLMP).

Tongass Deferred

No Alternative Selected at This Time; Determine Whether Road Construction Should be Prohibited in Inventoried Roadless Areas on the Tongass as Part of the 5-Year Plan Review

This alternative is a modification and combination of Alternatives T2 and T3 in the DEIS. When the decision was made to include procedures for the evaluation of roadless characteristics in the final Planning Regulations, all procedural alternatives were removed from this FEIS. Since the prohibitions included in Tongass Alternatives T2 and T3 were the same, once the procedures were removed, there was no need to maintain them both.

No alternative would be applied on the Tongass National Forest at this time. Rather, the responsible official for the Tongass would determine whether the prohibition against road construction and reconstruction should apply to any or all of the inventoried roadless areas on the Tongass. The responsible official's evaluation would be conducted in association with the 5-year review of the 1999 TLMP (beginning in April 2004).

In making that determination, the responsible official must consider, among other things, the provisions of Section 101 of the Tongass Timber Reform Act. This section, amending Section 705 of the Alaska National Interest Lands Conservation Act, requires the Agency to seek to provide a supply of timber from the Tongass National Forest that meets market demand, consistent with providing for the multiple use and sustained yield of all renewable resources, subject to appropriations, other applicable laws, and requirements of the National Forest Management Act of 1976.

Roading and timber harvest within inventoried roadless areas would continue as outlined in the 1999 Record of Decision for the TLMP until a determination is made on whether or not to apply the prohibitions as part of the 5-year plan review in 2004.

Tongass Selected Areas

Prohibit Road Construction and Reconstruction in Old Growth, Semi-Remote Recreation, Remote Recreation Land Use Designations, and LUD IIs within Inventoried Roadless Areas on the Tongass

This alternative was labeled Alternative T4 in the DEIS. Under this alternative, road construction and reconstruction activities, including temporary road construction, would be prohibited within inventoried roadless areas in the Old Growth, Semi-Remote Recreation, Remote Recreation, and LUD II land use designations. Roading and timber harvest within other inventoried roadless areas would continue as outlined in the 1999 Record of Decision for the TLMP.

This alternative is a modification of Alternative 2, Prohibit Road Construction and Reconstruction Within Inventoried Roadless Areas. A complete description of the goals, objectives, and desired future condition for these four specific land use prescriptions is found in Appendix E of this volume.

The Preferred Alternative

Based on responses received during the public comment period, the preferred alternative described in the DEIS has been modified, and it now includes:

Alternative 3 with Selected Social and Economic Mitigations

Prohibit Road Construction, Reconstruction, and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas, While Excepting Road Reconstruction Needed for Road Safety Improvements and Federal Aid Highway Projects

Tongass Not Exempt with Selected Social and Economic Mitigation

Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest Beginning in 2004

Road construction and reconstruction (including temporary road construction) and timber harvest except for stewardship purposes would be prohibited on 49.2 million acres of inventoried roadless area upon implementation of the final rule. This would increase to 58.5 million acres in April 2004 as the alternative is implemented on the Tongass. Stewardship purpose timber harvest could only be used where it maintains or improves roadless characteristics and:

- Improves threatened, endangered, proposed or sensitive species habitat;

- Reduces the risk of uncharacteristic wildfire effects; or
- Restores ecological structure, function, processes, and composition.

Exceptions to the prohibitions would be allowed in the following circumstances:

The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, section 311 of the Clean Water Act, or the Oil Pollution Act;
- A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; or
- Realignment is needed to prevent irreparable resource damage by a classified road. The road must be deemed essential for public or private access, natural resource management, or public health and safety, and the resource damage associated with the road cannot be corrected by maintenance.

The following social and economic mitigation measures, in the form of additional exceptions, have also been incorporated.

The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- Reconstruction is needed to implement road safety improvement projects on roads determined to be hazardous on the basis of accident experience or accident potential; or
- The Secretary of Agriculture determines that a Federal Aid Highway project authorized pursuant to Title 23 of the United States Code is in the public interest or is consistent with the purposes for which the land was reserved or acquired, and no other feasible alternative exists.

In conjunction with, but independent of this rule, the Chief of the Forest Service intends to work with States and communities and to pursue funds to help them respond to economic changes that may result from implementation of the final Roadless Rule. The Agency's success in securing appropriations for these purposes would have a direct bearing on its ability to actually implement the following programs.

The Chief of the Forest Service may implement one or more of the following provisions of an economic transition program for communities most affected by changes in management of inventoried roadless areas:

- Provide financial assistance to stimulate community-led transition programs and projects in communities most affected by changes in roadless area management;
- Through financial support and action plans, attract public and private interest, both financial and technical, to aid in successfully implementing local transition projects and plans by coordinating with other Federal and State agencies; and
- Assist local, State, Tribal and Federal partners to work with those communities most affected by the final roadless area decision.

The Tongass would be treated the same as all other forests in the National Forest System. Inventoried roadless areas on the Tongass would not be exempt from the final rule. However, as the result of public comment on the DEIS, implementation of the prohibitions would begin in April 2004, as provided below:

In Tongass Not Exempt, the final rule would include the following social and economic mitigation measure to provide a transition period for communities most affected by changes in management of inventoried roadless areas:

- The prohibition alternative selected for inventoried roadless areas on all other NFS lands would be applied to inventoried roadless areas on the Tongass in April 2004.

Following publication of the FEIS, the final Roadless Rule could be the same as this preferred alternative, or it could be a different combination of the alternatives and social and economic mitigation measures. The final decision will be documented in a Record of Decision and final rule, published no sooner than 30 days after the Notice of Availability of the FEIS.

4.0 Effects Analysis

This biological evaluation assessed the potential effects to TEPS species of prohibition action Alternatives 2, 3 and 4, in combination with the Tongass Alternatives. Prohibition Alternatives 2, 3 and 4 would have similar types of potential impacts to both TEP and sensitive species, with the exception of a prohibition on timber cutting under Alternative 4. Alternative 4 prohibits timber cutting except if needed to meet specific protection and conservation objectives for threatened, endangered and proposed species as identified in biological opinions, recovery plans or conservation strategies and when USFWS and/or NMFS (as applicable) are in agreement. It is not anticipated that this exception would be used frequently or for large-scale projects, but rather for conservation of specific habitat components necessary for continued species viability where a clear need is identified. The potential effects to TEPS species from the Tongass action alternatives would not vary substantially between alternatives.

In addition to the exception to the prohibition on timber harvest for conservation of TEP species in Alternative 4, all action alternatives offer an exception to the prohibition on road construction or reconstruction for situations where an existing road needs to be realigned in order to prevent irreparable resource damage, which is being caused by the road itself.

By comparing the action alternatives with the current policy and conditions described in the prohibition and Tongass NF no action alternatives, and by comparing how the action alternatives would affect the Forest Service management of roadless areas, it was possible to draw reasoned conclusions about potential effects to TEPS species and their habitats. It is important to recognize the differences between the kind of proposed actions being analyzed in this biological evaluation, as opposed to most biological evaluations for proposals that involve some kind of measurable landscape or species population disturbance. In this BE, we analyzed the effects of not doing something (i.e., road construction and/or timber harvest in inventoried roadless areas), which may not have ever been done anyhow, and where specifics regarding potential projects had not yet been developed. This necessitated the speculative nature of the determinations in regards to the extent and magnitude of potential effects, but did not affect the overall determinations, which were strongly rooted in current science, and which incorporated the results of species-specific reviews completed by each region.

4.1 Comparison of Alternatives

A summary comparison of the potential effects of the prohibition action alternatives includes:

All of the prohibition action alternatives would have potential beneficial effects to TEPS species when compared to Alternative 1 (no action alternative). All of the action alternatives would reduce the risk of future habitat loss, degradation, and disturbance within inventoried roadless areas when compared to Alternative 1.

Based on data collected from each forest, there would be minimal impacts through 2004 on activities proposed in approved recovery plans or conservation strategies, from all of the action alternatives when compared to Alternative 1. While this information cannot be used to determine what may be proposed beyond that timeframe, it does indicate that currently, the need for road construction in inventoried roadless areas for recovery or conservation projects for TEPS species is minimal, and it there is no reason to expect that to change.

The effects to TEPS species from prohibiting road construction and road reconstruction would be similar under Alternatives 2, 3 and 4, since that activity is equally curtailed under all of those alternatives. All action alternatives offer a set of exceptions to the prohibition on road construction and reconstruction, including situations where an existing road needs to be realigned in order to prevent irreparable resource damage, caused by the road itself. For example, this exception could be invoked to relocate a road in order to prevent substantial adverse effects to habitat for a threatened or sensitive fish species caused by excessive sedimentation from the existing road location, when such effects could not be avoided through maintenance.

Approximately 40% of the 58.5 million acres of inventoried roadless areas are covered by land management-plan prescriptions that currently prohibit road construction and reconstruction, while the other 60% does not. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1. If this rate of entry continues, over the next century, this could equal 50% of inventoried roadless areas being affected by roaded entry. The actual amount, however, would probably be much lower due to rugged terrain in many of these areas, and public controversy over entry into inventoried roadless areas.

An estimated 1,160 miles of permanent and temporary road construction or reconstruction is planned through 2004. Table 1 displays total planned offer volumes and miles of road construction and reconstruction through 2004, by alternative, both with and without the Tongass exemption. Timber harvest under this alternative would occur on an estimated 18,000 acres of inventoried roadless areas per year initially, dropping to about 14,000 acres annually in the long term.

The type and extent of impacts to terrestrial species and habitats from this road construction would depend on road location and design, mitigation measures applied, the activities that are enabled, the amount and kinds of other activities occurring in adjacent areas, current condition of species populations, and the kinds and intensities of natural and human-induced disturbances in the area. With application of current design standards and best management practices, the effects of these kinds of activities have been mitigated or avoided in many situations. Some effects, however, cannot be mitigated, such as increased levels of habitat fragmentation.

Table 1. Total planned timber offer and miles of road construction and reconstruction for all activities through 2004, by alternative.

	Total planned offer (MMBF [a])		Total miles road construction/reconstruction	
Alternative	**With Tongass National Forest exemption**	**Without Tongass National Forest exemption**	**With Tongass National Forest exemption**	**Without Tongass National Forest exemption**
1	1,100	1,100	1,160	1,160
2	840	300	597	293
3	700	160	597	293
4	0	0	597	293

[a] Million board feet

The effects of reduced levels of timber harvest would be similar under Alternatives 2 and 3. While Alternative 2 does not prohibit any type of timber harvest, the prohibition on road construction in this alternative would reduce the amount of timber harvest.

Alternative 3 prohibits timber harvest except for stewardship[2] purposes within inventoried roadless areas. As approximately 70% of the timber planned in inventoried roadless areas that would not require road construction (not including Tongass NF data) has been categorized as stewardship, the majority of the harvest that would be precluded under this alternative would be the result of the prohibition on road construction and reconstruction. Thus the effects of these two alternatives would likely be quite similar.

Alternative 4 would prohibit all timber harvest, with an exception available only to meet TEP species objectives. It is not anticipated that this exception would be used frequently or for large-scale projects, but rather for conservation of specific habitat components necessary for continued species viability where a clear need is identified. This exception would not apply to sensitive species.

The significance of beneficial effects to TEPS species for a specific inventoried roadless area would be dependent on the size of the area, kinds and extent of management-induced disturbances which have occurred in the past, the landscape context in which it is found, factors affecting species viability, and overall status of populations. Clearly, the magnitude and extent of such benefits cannot be conclusively determined at a national level, but it is reasonable to expect that, if a decision is made to conserve roadless values , beneficial effects could include one or more of the following:

- Contributions towards maintaining or restoring the ecological health of the area and the landscape in which it is found.
- Providing increased assurance that native biological diversity and native species viability will be effectively conserved, within both the area and the landscape in which it is found.
- Maintenance or restoration of some level of natural disturbance processes which are important controls for ecosystem composition, structure, and function.
- Supporting a diversity of habitat types, from early to late successional, particularly in those areas which are large enough in size to encompass a shifting mosaic of habitat patches in various stages of succession following disturbance.
- Maintenance of native species richness.
- Providing important components of conservation strategies for protection and recovery of TES species.
- Maintaining current resiliency of an area to non-native invasive species.
- Protecting an area from further management-induced habitat fragmentation and maintaining habitat connectivity.
- Contributing to protection of biological strongholds and refugia for many species, covering the spectrum from wide-ranging, disturbance-sensitive carnivores to narrow endemic mollusks and plants.

[2]Stewardship purpose timber sales are designed to achieve ecological objectives, other than timber harvest, that may require vegetative manipulation such as improving forest ecosystem health, removing nonnative species and replacing with native species, and improving wildlife habitat. Objectives that would be consistent with stewardship include: restoring an area to historic ecological conditions; improving the vigor of residual trees to withstand insects, disease, and wind; reducing excessive forest fuels through thinning; restoring ecological features and processes such as fire into an ecosystem; and creating desired wildlife habitat conditions.

A summary comparison of the potential effects of the Tongass action alternatives includes:

There are two threatened species (chinook salmon and Steller's sea-lion) and two endangered species (sockeye salmon and humpback whale) affected by the TNF. The potential impacts to threatened and endangered species would be relatively low under all Tongass alternatives, including the no action alternative, and would not vary significantly between alternatives, given the low number of species involved and the habitat utilized by those species. A total of 27 sensitive species (4 bird, 3 fish, 2 mammal and 18 plant) could potentially be impacted by the Tongass alternatives (see the sensitive species list in Attachment S1).

There are three Tongass National Forest (TNF) action alternatives, as described under section 3.4, above. No adverse effects to TEPS species were identified from the action alternatives. The degree of potential beneficial effects would vary by alternative, according to the timing and extent of prohibitions applied. The significance of beneficial effects to TEPS species for a specific inventoried roadless area is dependent on the size of the area, kinds and extent of management-induced disturbances which have occurred in the past, the landscape context in which it is found, factors affecting species viability, and overall status of populations. The Tongass Biological Resources Specialist Report describes the analysis and potential effects of the alternatives. That report is incorporated into this biological evaluation by reference.

4.2 Process for Determining Effects

To make a final determination of effects, the biological evaluation utilized a coarse filter analysis which included: (1) information gathered from each region identifying those species that have habitat within or are affected by inventoried roadless areas (see Attachments TEP1 and S1), (2) the current scientific literature on the effects of roads, timber harvest, and fire on terrestrial and aquatic species, and (3) a review of the species lists by biologists in each region to identify any species potentially adversely affected by any of the action alternatives. The following questions and associated responses provided the coarse filter analysis:

(1) What species are potentially impacted by inventoried roadless areas?

National Forest and Regional biologists, ecologists and botanists were asked to determine which TEPS species:

(1) are likely have habitats within inventoried roadless areas, or

(2) are not likely to have habitat within inventoried roadless areas, but could be affected by road construction or reconstruction in inventoried roadless areas.

A "Yes" response to (1) or (2) was identified for an estimated 239 (57%) of the 419 TEP species associated with NFS lands, and an estimated 1,942 (66%) of 2,944 sensitive species (see Attachments TEP5 and S3). Note that for this biological evaluation, each currently described anadromous salmonid ESU was counted as a separate species. An estimated 25 candidate species were identified as potentially impacted by inventoried roadless areas, out of a total of 44 candidate species affected by NFS lands.

(2) What designated or proposed critical habitat or Forest Service designated essential habitat is potentially impacted by inventoried roadless areas?

Based on their local knowledge, and a review of the appropriate records from the Federal Register, biologists at the national, regional and forest levels determined which threatened and endangered species had designated or proposed critical habitat within or affected by NFS lands. In addition, regional biologists were asked to identify any Forest Service designated essential habitat.

Over 50 species have designated critical habitat on NFS lands. Inventoried roadless areas provide or affect critical habitat for 35 of these species. Attachment TEP1 identifies which species have designated critical habitat in or affected by inventoried roadless areas.

Essential habitat, a Forest Service designation, is defined as those areas possessing the same characteristics as critical habitat without having been declared critical habitat (USDA 1995b). The endangered, neotropical migratory Kirtland's warbler is the only species with Forest Service designated essential habitat (USDI 1976). This warbler's essential habitat does not occur in, nor is it affected by, inventoried roadless areas.

(3) What is the environmental baseline in inventoried roadless areas?

Terrestrial Species

Inventoried roadless areas offer a range of habitat types, including grass and shrublands, young forested stands, and old growth forests, with the character, distribution, and extent of habitats affected by the size of the areas, the timing, kinds and intensity of management-induced and natural disturbances that have occurred, and the landscape context in which they are found. These lands provide large, relatively undisturbed blocks of important habitat for terrestrial animal species and communities. In addition to supplying or influencing habitat for more than 300 threatened, endangered, proposed and sensitive terrestrial animal species, they support numerous other game and nongame vertebrate and invertebrate species. Habitat in these areas is likely to be less fragmented from human activities and more likely to be better connected than in roaded areas of similar size.

Many of these inventoried roadless areas have been shown to function as biological strongholds and places of refuge for many species, covering the spectrum from wide-ranging carnivores to narrowly distributed endemic snails. Some of these areas may now and in the future play a much greater role in supporting species viability and biodiversity than in the past, due to cumulative degradation and loss of other, potentially more biologically rich habitat in adjacent landscapes. As such, these areas may be instrumental in maintaining native species viability and biodiversity. Native plant and animal communities tend to be more intact than in roaded areas of similar size, with species richness and native biodiversity more likely to be effectively conserved, particularly in those areas large enough to offer a shifting mosaic of patches in various stages of recovery from disturbance (Noss and Cooperrider 1994).

For example, in comparing the distribution of inventoried roadless areas with centers of biodiversity identified in the Interior Columbia River Basin Ecosystem Management Project (ICBEMP) (Quigley and Arbelbide 1997), these areas cover approximately 21% (1,650,000 acres) of the identified acreage in centers of biodiversity for animals. In addition, almost 10% (2,780,000) of the acreage identified in the ICBEMP as centers of endemism for animals is contained within inventoried roadless areas.

Inventoried roadless areas may function to provide some TEPS species with refugia from potential adverse human-related activities that are prevalent in roaded areas. Some of the potential direct and indirect adverse effects of these activities include:

- Habitat loss, fragmentation, negative edge effects, trampling, and fire resulting from human-caused ignitions.
- Habitat loss of snags and down logs, and rare and unique communities such as those found within talus slopes, cliffs, caves and wetlands.
- Spread of non-native invasive plants and animals, insects, disease and parasites.
- Overtrapping, excessive hunting or fishing pressure, poaching and illegal collecting.
- Harassment or disturbances that disrupt migration, dispersal, reproduction, foraging, rearing or loafing sites, and increase physiological stress.
- Barriers to movement and dispersal.
- Chronic negative interactions with people that may result in increased mortality, including mortality from collisions with vehicles.

Inventoried roadless areas may have lower human-caused fragmentation of forests, and may maintain greater habitat connectivity for species requiring interior habitats and/or large areas of intact ecosystems, relative to habitat found within roaded areas. Some species like the grizzly bear, wolf and lynx benefit from large undisturbed areas. In addition, other species like amphibians and birds with smaller home ranges benefit from intact, unfragmented interior forest habitats. Fragmentation in closed forest environments creates corridors by which all kinds of predators can enter and affect native animal populations.

Inventoried roadless areas may provide important habitat for those species that are sensitive to human disturbance. Human disturbance can disrupt species migration, reproduction, rearing of young, foraging and loafing behavior, and cause increased physiological stress. These disruptions can lead to displacement in population distribution or changes in habitat use. In chronic situations, human disturbance and interactions can result in extirpation of some species from human use areas. The result can be adverse trends in overall population levels.

Compared to roaded areas, species in inventoried roadless areas are less likely to be exposed to disruption from a variety of human activities such as collection, trampling, and other surface disturbance. These activities can directly affect the distribution and persistence of species populations. The lower level of disruption in inventoried roadless areas may make them important references for understanding the natural composition and dynamics of native plant and animal communities.

Large numbers of animals are killed annually on roads, including Forest service roads. In selected situations, such as for some amphibians and rodents with highly restricted home ranges, populations or rare animals may be reduced to dangerous sizes by road kills (USDA 2000).

Inventoried roadless areas provide large, relatively undisturbed blocks of important habitat for a wide variety of native plants, including numerous rare species, over 1,400 sensitive species, and nearly 100 threatened, endangered, and proposed plant species. Many of these are endemic species, with narrowly limited geographical ranges determined by soil types, climatic conditions, and other environmental conditions. Endemic species, due to their limited distribution, are often at a relatively higher risk of extinction. Areas in the United States with sizeable numbers of endemic plant species include California, Texas, Alaska, the Pacific Northwest, the Southwest, the Intermountain West, and the South (Gentry, 1986).

These areas may provide important biological strongholds for native plant species and communities. In comparing the distribution of these inventoried roadless areas with centers of biodiversity identified in the Interior Columbia River Basin Ecosystem Management Project (ICBEMP) (Lee and others 1997), inventoried roadless areas cover approximately 10% (2,810,000 acres) of the identified acreage for centers of biodiversity for plants. In addition, almost 10% (1,370,000) of the acreage identified in ICBEMP as centers of endemism for plants is contained within inventoried roadless areas.

Lacking roads and many of the disturbances associated with them, inventoried roadless and other unroaded areas are less likely to experience problems with non-native invasive species and are more likely to be able to maintain intact native plant and animal communities. Roads tend to be avenues for invasion by non-native invasive species that frequently compete with, prey upon, or displace native animals and vegetation. Competition by non-native invasive species is one of the leading causes for plant species being listed as endangered or threatened (Fay personal comm.).

Aquatic Species

Inventoried roadless areas support a diversity of aquatic habitats and communities, providing or affecting habitat for over 280 threatened, endangered, proposed and sensitive species, and numerous other aquatic species. Without the disturbances caused by roads and the activities that they enable, stream channel characteristics are less likely to be adversely altered compared with stream channel conditions found in roaded areas. Important characteristics that influence habitat quality for aquatic species include channel and floodplain configuration, amount of fine sediment in stream substrate, riparian condition, amount and distribution of woody debris, streamflow, water quality, and temperature regime (Furniss and others 1991). Smaller streams, such as many of those found in inventoried roadless areas, not only provide important habitat for resident and migratory aquatic species, but also play a central role by influencing the quality of habitat in larger, downstream reaches (Chamberlin and others 1991).

Illegal introduction and harvest of aquatic species is less likely to occur in these areas due to lack of ready access. Poaching of large, migratory bull trout, a native char found in the Northwest, has been described as an important cause of mortality (Lee and others 1997). Illegal introduction of non-native fish species has had measurable effects on native aquatic communities in many parts of the country. For example, the Sierra Nevada Ecosystem Project (SNEP) report (Moyle and others 1996) identified illegal introductions of predatory fish such as northern pike and white bass, and introductions of other non-native fish, as important causes for disruptions in native fish communities in Sierran waters.

Waters within inventoried roadless areas have been shown to function as biological strongholds and refuges for many fish species. The size of an area, timing, kinds and intensity of management-induced and natural disturbances that have occurred, and the landscape context in which it is found, all affect the quality, distribution, and extent of these habitats. Some of these waters may now play a relatively much greater role in supporting aquatic species viability and biodiversity than in the past due to cumulative degradation and loss of other, potentially more biologically rich habitat within associated drainages.

The Nature Conservancy and the Association for Biodiversity Information identified the United States as a global center of freshwater biodiversity (Chaplin and others 2000). In examining the distribution of 307 fish species and 158 mussel species that are imperiled or vulnerable, they identified 87 watersheds as aquatic biodiversity "hotspots," supporting 10 or more vulnerable or imperiled species. The majority of these watersheds are found in the southeast part of the country, with only one occurring west of the 100th meridian. Inventoried roadless areas are found within 29 of these watersheds, and likely play a role in supporting the continued survival of these species either directly through providing habitat, or indirectly by contributing to water quality within the drainage. Seventeen of these inventoried roadless areas are currently under management prescriptions that permit road construction.

Analysis done for the ICBEMP (Lee and others 1997) indicates that strong fish populations are frequently associated with areas of low road density. That analysis showed that increasing road densities (miles of road per square mile) and their attendant effects were associated with declines in the status of bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, and redband trout. Approximately 60% of unroaded or very low road density subwatersheds within the assessment area were found to support strong salmonid populations. This is in contrast to less than 25% of subwatersheds with moderate and 18% with high road densities (Quigley and others 1996).

Approximately 2 million acres of inventoried roadless areas contain high priority watersheds[3] identified in the ICBEMP for conservation of threatened Snake River chinook, with about half of those acres falling within those inventoried roadless areas where road construction is not prohibited by current management direction. An additional 5 million acres of inventoried roadless areas contain identified priority watersheds for conservation of bull trout and other species.

Table 2 lists, by state, the acreages of inventoried roadless areas within the ICBEMP assessment area that contain high priority watersheds for conservation of Snake River chinook. It also displays the total acreages of inventoried roadless area within priority watersheds identified for conservation of bull trout, watersheds with potentially "critical habitat" for anadromous species not listed as of March 1996, and watersheds containing high quality habitat but no federally listed species as of March 1996. Cumulatively, the data indicate that over 30% of the acreage in designated priority and high priority watersheds for aquatic species are within inventoried roadless areas.

A substantial amount of inventoried roadless areas provide important habitat for Pacific anadromous fish species. Table 3 shows the acreage of inventoried roadless areas that lie within the habitat range of Pacific salmonids including those for chinook, chum, coho, and sockeye salmon, as well as steelhead and coastal cutthroat trout. Table 3 also shows acreages of inventoried roadless areas specific to federally listed Pacific salmonids.

[3] Priority Watersheds were identified in the ICBEMP (Quigley and Arbelbide 1997) as those important for conservation of bull trout (from the Inland Fish Strategy), or with potentially "critical habitat" for anadromous species not listed as threatened or endangered under the Endangered Species Act as of March 1996 (from PACFISH); or as watersheds containing high quality habitat but no listed species as of March 1996.
High Priority Watersheds were identified for conservation of Snake River chinook salmon, listed as threatened under the Endangered Species Act.

Table 2. Inventoried Roadless Areas in ICBEMP Priority and High Priority Watersheds. *(Roadless GIS Database 2000)*

State	**Inventoried Roadless Areas in ICBEMP Priority Watersheds** (acres)	**Inventoried Roadless Areas in ICBEMP High Priority Watersheds** (acres)
Idaho	2,952,000	1,937,000
Montana	1,527,000	Not Applicable
Nevada	10,000	Not Applicable
Oregon	429,000	92,000
Washington	174,000	45,000
Total	5,092,000	2,074,00

Table 3. Habitat for Pacific Anadromous Fish Species Within Inventoried Roadless Areas, by Species. *(National Marine Fisheries Service, Roadless GIS Database 2000)*

Species	**Inventoried Roadless Areas within the Range of Pacific Salmonids** (acres)	**Inventoried Roadless Areas within the Range of Threatened and Endangered Pacific Salmonids** (acres)
Chinook Salmon	8,869,000	6,314,000
Chum Salmon	1,401,000	95,000
Coho Salmon	1,823,000	1,175,000
Sockeye Salmon	258,000	179,000
Steelhead	7,593,000	6,033,000
Coastal Cutthroat Trout	1,884,000	156,000

In considering the contributions of large unroaded areas for conservation of aquatic habitats and species, comparisons can be drawn from research in other areas lacking roads and with minimal levels of human disturbance. For example, in evaluating the role of wilderness areas in conserving aquatic biological integrity in western Montana, Hitt and Frissell (1999) concluded that, although the presence of wilderness does not guarantee aquatic biological integrity due to factors such as fish stocking practices and impacts from adjacent roads, "the importance of wilderness in aquatic conservation is extraordinary". Their analysis showed that over 65% of waters that were rated as having high aquatic biological integrity were found within subwatersheds containing designated wilderness. They also concluded that, given the relative rarity of unprotected areas that support a relatively greater degree of aquatic biological integrity, undisturbed areas warrant permanent protection.

(4) What are the potential effects of roads to proposed, threatened, endangered, and sensitive species and their habitats, which may be avoided by implementation of a prohibition of road construction and reconstruction within inventoried roadless areas?

Almost all roads present some level of benefits, problems, and risks, although these effects can vary greatly in degree (USDA 2000). Roads permit motorized access, creating a broad spectrum of options for management, while foreclosing other management options, such as wilderness, non-motorized recreation, or some types of wildlife refugia.

The effects of roads can shift over time. Some effects are immediately apparent, but others may require external events, such as a large storm, to become visible. Still other effects may be subtle, such as increased susceptibility to invasion by non-native species or pathogens noticed only when they become widespread in the landscape, or with increased road use as recreation styles and motor vehicles change (USDA 2000).

Gucinski and Furniss in *Forest Roads: A Synthesis of Scientific Information* (USDA 2000), identified a number of road-related benefits and negative consequences. The benefits can include access for a variety of activities including: timber acquisition, grazing, mining, recreation, law enforcement, fire suppression, land management, research and monitoring, access to private land holdings, watershed restoration, species and habitat management, critical community needs, and subsistence, as well as the cultural value of roads themselves. The negative consequences of roads can include: adverse alterations in watershed hydrology, increased slope instability and geomorphic features such as debris slides, increased stream sedimentation, habitat fragmentation, increased predation, road kill, invasion by non-native plants and animals, dispersal of pathogens, water quality degradation and chemical contamination, use conflicts, lowered soil productivity and loss of native biodiversity.

A road-related beneficial effect for one species, may, in fact, represent an adverse effect for another. For example, although forest edges, such as those created by road construction and timber harvest, may benefit species such as deer and bobwhite quail, they also provide access to interior forest patches for opportunistic species, such as the brown-headed cowbird, with effects extending up to 600 meters into forest interiors from an edge (Norse and others 1986). Cowbirds have been implicated in the decline of certain songbirds in the Sierra Nevada, including the willow flycatcher, least Bell's vireo, yellow warbler, chipping sparrow, and song sparrow (Sierra Nevada Ecosystem Project 1996).

The current literature (USDA 1999, USDA 2000, Wisdom and others 2000, Trombulak and Frissell 2000) does not identify any clear, direct beneficial effects specific to TEPS species from roads. However, roads do facilitate access for ecological restoration activities such as stewardship timber harvest and watershed restoration, and could therefore have indirect beneficial effects to some TEPS species (see also questions 5 and 6).

The potential negative effects of roads to terrestrial and aquatic systems (including TEPS species) have been well documented (USDA 1999, USDA 2000, Wisdom and others 2000, Trombulak and Frissell 2000). These effects are believed to be widespread and profound (USDA 2000).

Trombulak and Frissell (2000) described seven general effects of roads on terrestrial and aquatic ecosystems: (1) mortality from road construction, (2) mortality from collision with vehicles, (3) modification of animal behavior, (4) alteration of the physical environment, (5) alteration of the chemical environment, (6) spread of non-native invasive species, and (7) increased use of areas by humans. They concluded that, although all species and ecosystems are not affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems. These effects included changes in species composition and population size. No terrestrial or aquatic species appears immune to some aspect of these factors. Populations of TEPS species may be particularly vulnerable to these effects since their populations are already experiencing an increased risk.

Terrestrial Species

Wisdom and others (2000) identified factors that were consistently associated with roads in a manner deleterious to terrestrial vertebrates. These factors, while identified in association with the Interior Columbia River Basin, are likely applicable to a variety of species for the following reasons identified by Gucinski and Furniss (USDA 2000): (1) the road and road-associated effects described by Wisdom and others (2000) were synthesized from research conducted across the world; (2) the synthesis focused on multiple species that encompassed diverse taxa and environmental requirements; (3) the synthesis addressed a wide range of environmental conditions on federal lands administered by the Forest Service, the Bureau of Land Management, and a multitude of state, private and tribal land owners; and (4) the synthesis focused on large-scale, over-arching effects common to many species and conditions of similar behavior and habitats use.

Road factors that can adversely affect terrestrial species include direct effects such as:

- Habitat loss.
- Habitat fragmentation.
- Edge effects.

Indirect effects of roads related to the amount and types of human activities associated with the road include:

- Displacement and avoidance.

- Poaching and over-trapping.
- Chronic negative interactions with humans.
- Direct mortality from vehicles and recreational shooting.
- Harassment and disturbance.
- Dispersal and movement barriers.
- Lethal toxicity.
- Introduction and spread of non-native invasive species.

Habitat Loss, Fragmentation and Edge

Road construction (Wisdom and others 2000) and associated road maintenance can convert large areas of habitat to nonhabitat (USDA 1999). Because roads affect more area than the actual road surface, they can reduce available habitat well beyond the road itself. Roads facilitate human activities that disturb habitats and displace animals or cause them to avoid habitats that would otherwise be suitable. For example, there is strong evidence that forest roads displace spotted owls and marbled murrelets, and that this displacement results in a significant amount of habitat loss exceeding that caused by the actual road surface (USDA 2000). Available grizzly bear habitat in the Cabinet Mountains was reduced by as much as 28% because of road avoidance behavior (Fredrick 1991). The majority of wolves in Montana occupy sparsely populated or wilderness areas (Ream and Mattson 1982) where few roads and associated human activities occur. This range restriction may occur because roads (and associated human activities) occur in other available habitat.

Travel Barriers

Habitat loss can result from the travel barriers caused by roads. For example, studies cited by Trombulak and Frissell (2000) indicate that the land snail *arianta arbustorum* (Baur and Baur 1990) avoids even unpaved and narrow roads. Other examples are provided by Merriam and others (1988), Swihart and Slade (1984), and Oxley and Fenton (1974) who found that some rodent species are reluctant to cross even the narrowest gravel roads. Weatherhead and Prior (1992) found that the threatened eastern massasauga rattlesnake avoided open areas including roads. This behavior can result in substantial amounts of suitable habitat being unavailable to these species. In addition, habitat loss can fragment populations into smaller subpopulations through loss of habitat connectivity, causing demography fluctuations, inbreeding, loss of genetic variability, and local population extinctions (USDA 2000). In Germany, roads which act as barriers to gene flow in a common frog (*Rana temporaria*) have lead to significant genetic differentiation among populations (Reh and Seitz 1990).

Spread of Non-native Invasive Plants and Animals

In terrestrial ecosystems, the edge effect of roads can resonate substantial distances from the road surface (Trombulak and Frissell 2000, USDA 2000). The construction of roads introduces new edge habitat, and consequently, edge-dwelling species of plants, birds and animals can be introduced into forest environments, adversely affecting interior forest-dwelling species. For example, building roads into interior forest patches can lead to invasions by parasitic cowbirds and non-native invasive plants (USDA 2000). Trombulak and Frissell (2000) cite studies by Wester and Juvik (1983), Henderson and Wells (1986), Tyser and Worley (1992) and Wein and others (1992) showing that some non-native invasive plants establish themselves preferentially along roadsides and in other disturbed habitats. The establishment of these species can lead to habitat loss and lowered reproductive success for some TEPS plant and wildlife species.

Roads serve as a means of entry for many non-native invasive plant species, with seeds or plant parts inadvertently transported into previously unaffected areas. Ground disturbance associated with roads and with other activities enabled by roads provides additional opportunity for establishment or expansion of non-native invasive plant populations (Parendes and Jones 2000).

Aggressive non-native invasive plant species tend to undermine native plant diversity through competition and habitat alteration. For example, the Sierra Nevada, an area historically rich in plant diversity with over 3,500 native species, now supports hundreds of non-native species, many of which have had considerable detrimental ecological effects (Sierra Nevada Ecosystem Project 1996). Other parts of the country show similar situations. Areas infested with invasive species such as spotted knapweed and leafy spurge have been found to have much lower productivity of grasses (Hillis 1999). Once established, many of these species are extremely difficult to eradicate. The use of herbicides associated with control efforts can have unintended adverse effects to populations of other terrestrial and aquatic species (Norris and others 1991).

Human Disturbances

Roads facilitate human activities that result in habitat disturbances, and direct and indirect mortality of some plant and animal species. These activities can result in significant amounts of habitat that are under-used by many species because they are negatively affected by road-associated factors (USDA 2000). In addition, populations of plants and animals can be reduced to levels that place them at risk.

Wisdom and others (2000) identified these potential adverse effects to species from human activities:

- Loss of large trees, snags and logs in areas adjacent to roads through commercial harvest or firewood cutting has adverse effects on cavity dependent birds and mammals (Hann and others 1997).
- Roads facilitate poaching (Cole and others 1997) of many large mammals, such as caribou, pronghorn, mountain goat, bighorn sheep, wolf, and grizzly bear (e.g., Dood and others 1985, Knight and others 1988, McLellan and Shackleton 1988, Mech 1970, Stelfox 1971, Yoakum 1978).
- Bats are vulnerable to disturbances and displacement caused by human activities in caves and mines, and on rock faces (Hill and Smith 1984, and Nagorsen and Brigham 1993).

- Ground squirrels often are a target of recreational shooting, which is facilitated by human developments and road access (Ingles 1965). Many local endemic ground squirrels with small, isolated populations are vulnerable to recreational shooting facilitated by roads.
- Roads provide access for chronic, negative interactions of humans with wolves and grizzly bears (Mace and others 1996, Mattson and others 1992, Thiel 1985), increasing mortality of both species and often causing high-quality habitats near roads to serve as population sinks (Mattson and others 1996, Mech 1973).
- Reptiles seek roads for thermal cooling and heating, and experience substantial mortality from motorized vehicles (Vestjens 1973).
- Roads also facilitate human access into habitats for collection and killing of reptiles; many species are sensitive to harassment or human presence during particular seasons, with potential reductions in productivity, increases in energy expenditures, or displacements in population distribution or habitat use (Bennett 1991, Mader 1984).
- Roads often restrict the movements of small mammals (Mader 1984, Merriam and others 1988, Swihart and Slade 1984) and can function as barriers to population dispersal (Oxley and Fenton 1974).

Trombulak and Frissell (2000) identified some additional potential negative effects:

- Amphibians may be especially vulnerable to roadkill because their life histories often involve migration between wetlands and uplands, and individuals are inconspicuous and sometimes slow moving. Roads can be demographic barriers that cause habitat and population fragmentation (Joly and Morand 1997).
- Bald eagles and sandhill cranes were also found to avoid nesting near some roads (Anthony and Isaacs 1989, Paruk 1987, Norling and others 1992).

Trombulak and Frissell (2000), in their review of scientific literature on the ecological effects of roads, identified seven general, potential effects of roads: mortality related to construction, mortality from being hit by vehicles, behavioral modifications, changes in the physical environment, changes in the chemical environment, introduction and establishment of nonnative species, and increased human use of roaded areas. They concluded that, although not all species and ecosystems are affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems. These effects included detrimental changes in species distribution, composition, and population size.

Ruediger and Mealey (1978) concluded that the greatest impact of roads on grizzly bear populations appears to arise from the increased human access they provide. Construction of roads into remote, previously unroaded areas encourages human development, recreational use and development, timber harvesting, mining, grazing and other land uses. Fredrick (1991) cites studies (Aune and Kasworm 1989, McLellan and Shackleton 1988, McLellan and Mace 1985, Archibald and others 1987) showing that grizzlies accustomed to human activity might be less strongly affected than bears in relatively remote areas. While reactions to human activities may vary, human activities in grizzly bear habitat can lead to increased human-bear confrontations and ultimately reduce habitat availability and grizzly populations.

Although only used for relatively short periods, temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in an area to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the area than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used for periods ranging up to ten years, and are then decommissioned, their short- and long-term effects can be extensive to terrestrial species and habitats.

In addition to posing many of the same risks as road construction, road reconstruction could result in substantial changes in the kinds and amount of human uses in an area. Improvements such as realignment or improving road surfacing or gradient to provide easy access for low clearance vehicles may promote increases in the amount of human disturbances and disruptions to species and habitats, exceeding those previously experienced before reconstruction.

Aquatic Species

Road construction, maintenance, use, and even the presence of roads in a watershed, can have numerous significant adverse effects to aquatic systems and the species which they support. These effects can include (Furniss and others 1991; USDA 2000):

- Increasing sediment loads in streams.
- Modifying watershed hydrology and stream flows.
- Altering stream channel morphology.
- Increasing habitat fragmentation and loss of connectivity
- Degrading water quality, including increasing chance of chemical pollution.
- Altering water temperature regimes.
- Providing avenues for introduction of disease or non-native species.
- Increasing fishing pressure.

These physical alterations can potentially result in a variety of adverse effects to aquatic species including:

- Loss of spawning and rearing habitat, and deep pools, from excess sediment deposition;
- Increased mortality of eggs and young from lower levels of oxygen in stream gravels;
- Increased susceptibility to disease and predation;
- Increased reproductive failure;

- Shifts in macro invertebrate communities to those tolerating increased sediment or other types of diminished water quality;
- Increased susceptibility to over harvest and poaching;
- Loss of protective cover and resting habitat through changes in channel structure including large woody debris, overhanging banks, and deep pools;
- Competition from nonnative species;
- Loss of habitat caused by habitat degradation, barriers to passage, increased gradient, high temperatures, and other factors; and
- Increased vulnerability of subpopulations to catastrophic events and loss of genetic fitness, related to loss of habitat connectivity.

Sedimentation

Gucinski and Furniss (USDA 2000) cite several studies that conclude roads contribute more fine sediment to streams than any other land management activity (Gibbons and Salo 1973, Meehan 1991) and that construction of road networks can greatly accelerate erosion rates within watersheds (Beschta 1978, Gardner 1979, Reid and Dunne 1984, Swanson and Dyrness 1975; Swanston and Swanson 1976).

Roads often increase the risk of catastrophic slope failures and debris torrents that may occur during flood events (Furniss and others 1991). Furniss and others (1991) concluded that the frequency of mass wasting events associated with roads can be greater than 300 times that found in an undisturbed forest in comparable terrain. Because mass wasting events associated with roads are often relatively large, the amount of sediment from roads greatly exceeds the amount from forests and clearcuts. The risk of mass wasting events within unroaded areas may be of particular importance because many of the remaining unroaded areas contain steep and often unstable slopes. Thus, roading in these areas can represent a particularly high risk of catastrophic landsliding, slope failures, and debris torrents with resulting adverse impacts to water quality an aquatic habitats.

A joint study by the Forest Service and Bureau of Land Management in Oregon and Washington found that of 1290 slides reviewed in 41 subwatersheds, 52% were related to roads, 31% to timber harvest, and 17% to natural forest (USDA 1996). An evaluation of landslides initiated by the Siuslaw National Forest found that roads were the source of 41% of the slides; harvest units less than 20 years old were the source of 36%, while natural forest accounted for the remaining 23% (USDA 1997). A study by the Oregon Department of Forestry did an intense ground survey of 506 landslides and found that most slides were located in existing forest stands and relatively few were caused by active or old roads, although slides from roads were larger than those in other settings (Robison and others 1999). Other studies on the Clearwater National Forest in Idaho (McClelland and others 1997) and the Mt. Hood National Forest in Oregon (DeRoo and others 1998) found that roads and timber harvest were major causes of landslides.

Roads can be a chronic source of sediment to streams (Swanston 1991). The loss of ground cover and exposure of mineral soil caused by roads can lead to chronic surface erosion. Roads and related ditch networks are often connected to streams via surface flowpaths, providing a direct conduit for sediment. Where roads and ditches are maintained by periodic "blading," the amount of sediment delivered continuously to streams may temporarily increase as bare soil is exposed and ditch-roughness features which store and route sediment are removed. Improperly maintained roads may still fail, years after construction (Furniss and others 1991).

Road surface erosion is particularly affected by traffic, which increases sediment yields substantially (Reid and Dunne 1984). Other important factors that affect road surface erosion include condition of the road surface, timing of when the roads are used in relation to rainfall, road prism moisture content, location of the road relative to watercourses, methods used to construct the road, and steepness on which the road is located. Roads built near watercourses can destabilize streambanks, and constrain the natural geomorphological migration of the stream channel.

Construction of road networks can also greatly accelerate erosion rates within a watershed (Beschta 1978; Gardner 1979; Haupt 1959; Kelsey and others 1981; Reid and Dunne 1984; Swanson and Dyrness 1975; Swanston and Swanson 1976). Cederholm and Reid (1981) reported that the percentage of fine sediments in spawning gravels increased above natural levels when roads covered more than 2.5 percent of a basin area.

Stream crossings can also be a source of sedimentation, especially if they fail or become plugged with debris, causing debris torrents and significant cumulative impacts downstream (Furniss and others 1991; Murphy 1995). When a culvert is plugged by debris or is overtopped by high flows, streams associated with these structures can be diverted, can contribute to road failure, and can cause severe sedimentation (Murphy 1995). Although proper design and location of these structures can minimize the risk of structural failure, any crossing structure is almost certain to fail if it is not maintained or removed when a road is abandoned (USDA and others 1993, Murphy 1995). Even proper culvert design and location is not proof against failure: for culverts designed for a 25-year flood, there is an 80 percent probability of failure over a 50-year period; for culverts designed for a 100-year flood, there is a 40 percent probability of failure over that same 50-year interval (USDA and others 1993). The effects of such failures on the habitat of threatened and endangered species that occupy streams within or downstream of inventoried roadless areas depend on the location, timing, and magnitude of the failures, as well as the overall condition of the aquatic ecosystem, the status of the species present in the associated drainages, and the Forest Service response to such failures.

Sediment entering stream channels can clog streambed gravels, reducing oxygen concentrations critical to incubating eggs, young fish, and macroinvertebrates, fill deep pools, and change channel shape and form, all of which can have adverse effects on aquatic species (Bjornn and Reiser 1991, Hicks and others 1991, Furniss and others 1991). Increased fine-sediment composition in stream gravel has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation on fishes (USDA 2000). Similarly, populations of tailed frogs can be severely reduced or eliminated by increased sedimentation (Corn and Bury 1989, Welsh 1990). Trombulak and Frissell (2000) cited a study by Findlay and Houlahan (1997) showing that herptile species diversity in wetlands declined in relation to the density of roads within 2 km of the perimeter.

Watershed hydrology and stream channel morphology

Road networks can affect hillside drainage; intercepting, diverting, and concentrating surface and subsurface flow, and increasing the drainage network of watersheds (Hauge and others 1979; Wemple and others 1996). This can lead to changes in peak and base flows in streams. Timing of water runoff can change as roads and related drainage structures intercept, collect, and divert water. This accelerates water delivery to the stream. More water becomes storm runoff increasing the potential for runoff peaks to occur earlier, be of greater magnitude, and recede quicker than in unroaded watersheds (Wemple and others 1996). Roads can also indirectly affect flow volume, since they replace trees that use water through evapotranspiration (loss of water from the soil through evaporation and from plants through transpiration). Water otherwise used by trees would become available for runoff or entry into the soil rather than returned to the atmosphere.

Changes in water timing are most likely to occur in areas with large amounts of timber harvest and roading since they have the highest potential to alter natural hydrologic processes. Areas with greater variability in seasonal precipitation and runoff, such as the arid and semi-arid portions of the West, would be more sensitive to timing than areas with more even rates of precipitation and runoff, such as the humid portions of California, Oregon, and Washington, and the entire East. Changes in the magnitude of flood flow peaks and seasonal low flows are more evident in drier climates (Neary and Hornbeck 1994).

Roading and vegetation management have the potential to change stream channel morphology. Alluvial streams normally exist in a state of dynamic equilibrium, where stream shape (slope, width, depth, sinuosity) adjusts to incremental changes in sediment and water inputs but retains the same general shape over time (Lane 1955, Heede 1980). Sizable changes in sediment and water inputs can throw the channel out of equilibrium, causing it to adjust to a different form with very different functions and values (DeBano and Schmidt 1989a and 1989b, LaFayette and DeBano 1990, Furniss 1991, Rosgen 1996).

Large additions of sediment or removal of water can reduce the stream's ability to transport sediment, causing the channel to aggrade. Sediment inputs from landslides or reductions in water flow in the channel through diversions or ditch placement can cause these changes. Reducing normal sediment loads or increasing the flow in a stream can increase sediment transport and cause the channel to cut into it's bed or banks, degrading the channel system.

Roads placed within floodplains or in close proximity to streams can confine the channel, change meander patterns, increase the channel slope, and cause degradation. Changes in channel morphology may take years or decades to recover.

Accelerated changes in stream channel morphology and alterations in flow can adversely affect aquatic species by causing a loss of important habitat attributes such as overhanging banks, spawning substrate, deep pools and riffles, winter refugia, and water temperature and volume, affecting virtually all life stages and the overall quality of habitat.

Habitat fragmentation and connectivity

Stream crossings can restrict channel geometry and prevent or interfere with migration of adult and juvenile salmonids (Furniss and others 1991). Gucinski and Furniss (USDA 2000) cited studies showing that: (1) 13 percent of the historical coho habitat in a large river basin in Washington, was lost because of improper culvert barriers (Beechie and others 1994); (2) total taxa richness and some species-specific richness were negatively related to the number of stream crossings (Hawkins and others In press); and (3) there were significant differences between macroinvertebrate assemblages above and below road stream crossings (Newbold and others 1980);

When habitat connectivity is lost, sub-populations loose the ability to interact, making a species more vulnerable to local extirpations and extinction from any cause, as there is no effective means of re-colonizing areas where populations have been lost. The lack of genetic interchange in an isolated subpopulation or in one with severely restricted size can lower its ability to adapt or respond to changing environmental conditions, resulting in an increased long-term risk to species viability (Gilpin and Soule 1986, Lee and others 1997). While the localized effect of an individual road stream crossing may or may not have a substantial adverse effect, the cumulative effect of road networks and multiple crossings increases the potential for major adverse effects to aquatic habitats.

Water quality

Road construction and timber harvest can result in measurable reductions of water quality by introducing sediment, nutrients, and chemical pollutants, by causing abnormal temperature fluctuations, and by indirect effects from human use. Some pollutants are from road construction and maintenance equipment, or are brought into the watershed through public road use. Road construction and timber harvest may cause water temperature to change where groundwater is intercepted and brought to the surface or where loss of tree cover in riparian areas reduces shading (Hornbeck and Leak 1992). Temperature changes may rise sharply in exposed areas then return to normal levels as water re-enters shaded areas downstream or receives cool inflow from other streams or groundwater (Pierce and others 1992). Smaller and/or shallower streams are more susceptible to temperature fluctuations than larger and/or deeper streams (Chamberlin and others 1991).

Removal of riparian canopy associated with road construction and maintenance can elevate stream temperatures to levels which have adverse physiological effects on aquatic species, and can result in increased mortality rates and lower reproductive success. Elevated temperatures can inhibit upstream migrations, increase disease susceptibility, reduce metabolic efficiency, and shift species assemblages (Beschta and others 1987, and Hicks and others 1991).

Introduction of non-native species and diseases

Introductions of non-native fishes and other aquatic species, whether authorized or unauthorized, have the potential to affect the distribution and abundance of native fishes, amphibians, and other aquatic organisms through competition, hybridization, predation, and introduction of parasites and diseases. Non-native aquatic plants may also be inadvertently introduced to lakes and streams from boats and boat trailers. Unauthorized releases of aquarium fishes, bait fishes, non-native amphibians and reptiles, and non-native plants to streams and lakes are strongly influenced by the presence of roads(USDA 1999; Lee and others 1997, Allan and Flecker 1993).

Overharvest and illegal harvest

The presence of a road system and associated facilities accessing streams, lakes, and wetlands where at-risk species may live can contribute significantly to declines in rare and unique native vertebrate populations or to damage of important habitats (USDA 1999) due to overharvest and illegal collection.

General effects of roads on aquatic species

For aquatic habitats, the indirect effects of disturbances could extend well beyond those areas directly impacted, given the influence that upslope areas and upstream reaches have on condition of downstream habitat (Chamberlin and others 1991). The type and extent of impacts on aquatic habitats would depend on road location and design, proximity to accessible habitat, mitigation measures applied, and the activities that are enabled. For fish populations, habitat alterations can adversely affect all life-stages, from egg to adult, and can adversely modify habitat essential for migration, spawning, incubation, emergence, rearing, feeding, and security (Furniss and others 1991). The Sierra Nevada Ecosystem Project documented a negative correlation between the abundance of roads in a watershed and the integrity of native stream biota (Moyle and Randall 1996).

In their review of scientific literature on the ecological effects of roads, Trombulak and Frissell (2000) concluded that, although all species and ecosystems are not affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems, including changes in species composition and population size. Roads were identified as one of the four most important factors affecting Sierran waters (Moyle and others 1996).

The U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1998b) found that bull trout are exceptionally sensitive to the direct, indirect, and cumulative effects of roads. Trombulak and Frissell (2000) cite studies (Rieman and others 1997, Baxter and others 1999) that show that the status or abundance of bull trout populations is inversely correlated to road density among streams in the Pacific Northwest. Dunham and Rieman (1999) demonstrated that disturbance from roads was associated with reduced bull trout occurrence. They concluded that conservation of bull trout should involve protection of larger, less fragmented, and less disturbed (lower road density) habitats to maintain important strongholds and sources for naturally recolonizing areas where populations have been lost.

Analysis of fish distribution and status data for seven species of anadromous and resident salmonids in the Columbia basin showed that the frequency of strong populations generally declined with increasing road densities (USDA 2000). Road construction was identified as an important factor in the regional decline and loss of populations of some inland cutthroat trout subspecies including Colorado River, westslope, Bonneville, and Yellowstone cutthroat trout (Young ed., 1995, Duff ed. 1996).

The biological opinion issued by the National Marine Fisheries Service for PACFISH (Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California) (USDA and USDI 1995) identified roads as a primary cause of salmonid decline, and indicated that roads may have unavoidable effects on streams, no matter how well they are located, designed or maintained. In discussing the effects of management activities in roadless areas in the Pacific Northwest, the scientific analysis team headed by Jack Ward Thomas (Thomas and others 1993) concluded that such activities would increase the risk of damage to aquatic and riparian habitat, and could potentially reduce the capacity and capability of key watersheds important for maintaining salmonid populations. Increased access into inventoried roadless areas would also increase the likelihood of disruption of native species communities with illegal or inadvertent introductions, as discussed under the affected environment.

In the broadscale assessment of aquatic species and habitats in the Columbia River Basin (Lee and others 1997), sizeable losses of both large pools and deep pools were found in streams in managed areas (multiple-use, roaded areas) over the last 50 to 60 years, compared with streams in unmanaged areas. This analysis showed that streams in 20 managed watersheds in the Central Idaho Mountains ecological reporting unit (ERU) had a 40% decrease in the frequency of large pools, whereas large pools in 11 unmanaged streams in the same ERU showed no noteworthy change. A substantial decrease was also found in the frequency of deep pools in managed streams in this ERU, in contrast with a considerable increase found in streams in unmanaged areas. Pools showed a clear decline in size and frequency with increasing road density.

Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in a watershed to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the watershed and to aquatic ecosystems than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used for periods ranging up to 10 years before decommissioning, their short- and long-term effects on aquatic species and habitats can be extensive.

In addition to posing many of the same risks as road construction, road reconstruction could result in substantial changes in the kinds and amount of human uses in an area. Improvements such as realignment or improving road surfacing or gradient to provide easy access for low clearance vehicles may promote increases in the amount of human disturbances and disruptions to species and habitats, exceeding those previously experienced before reconstruction.

Conclusion

Given the numbers, diversity, and distribution of TEPS terrestrial and aquatic species that have habitat within the area affected by the proposal, a prohibition on road construction and reconstruction would provide important national conservation for these species and their habitats. Without road construction, and many of the activities that roads enable, there would be a lower likelihood of future habitat degradation, fragmentation, and loss, introduction of non-native species, harassment, disruption, and illegal take, relative to the no action alternative. With the exception provided under all of the prohibition action alternatives that an existing road may be realigned to prevent irreparable resource damage, adverse effects to TEPS and other species caused by existing roads may be mitigated. Overall, effects to conservation of TEPS species would be beneficial.

(5) What are the potential effects of timber harvest to proposed, threatened, endangered and sensitive species and their habitats, which may be avoided by implementation of a prohibition of some or all timber harvest within inventoried roadless areas?

The effects of timber harvest activities on terrestrial and aquatic TEPS species can be both negative and positive. Timber harvest creates forest age class diversity and mosaic habitats utilized by some species (Wisdom and others 2000, USDA 2000, Southern Appalachian Man and the Biosphere 1996, USDA 1995a, USDI 1990, USDI 1976). Some species require early seral or open-forest habitats that can be created and maintained by properly planned, restorative timber harvest. Timber harvest activities may also reduce the risk of uncharacteristic large stand-replacing insect and disease outbreaks and wildfires. These disturbance events, can present both benefits and risks to some TEPS habitats (Wisdom and others 2000, USDI 1995a, USDA and others 1993), at least at a local level.

There are potential tradeoffs when considering timber harvest activities as a habitat management tool. There is substantial documentation in current scientific literature on the negative effects of timber harvest on many species and their habitats (USDA 2000, Wisdom and others 2000, Jules 1998, Noss and Cooperrider 1994, Ruggiero and others 1994, Meehan 1991, Chamberlin and others 1991, Norse and others 1986).

Terrestrial Species

Benefits and Risks of Timber Harvest

The benefits to terrestrial species from timber harvest activities are generally due to creating or maintaining some specific habitat condition. Some examples of timber harvest benefits include:

- Timber harvest can be used to benefit species like the red-cockaded woodpecker (USDA 1995a), Florida Scrub Jay (USDI 1990), and Kirtland's warbler (USDI 1976) by creating and maintaining open forest or early seral conditions.
- The Mexican spotted owl may benefit from timber harvest activities that maintain and develop large old growth pine habitats, and alleviate risk from wildfire, insects, and disease (USDI 1995).
- The rock gnome lichen and Ute-ladies'-tresses plant species require open, park-like and early-mid seral forest conditions that can be provided through timber harvest activities.
- The snowshoe hare, a primary lynx prey species, can benefit from properly planned regeneration harvests (USDA and others 2000).
- Reynolds and others (1991) suggest that active management activities like tree thinning may be beneficial in producing and maintaining the desired conditions for sustaining goshawks and their prey species.

There are potential risks of adverse effects associated with harvesting timber. Adverse effects of timber harvest can vary, depending on the amount, type and location of timber harvest, overall watershed condition, status of species within the affected area, and the mitigation measures applied. In addition, activities associated with timber harvest, including post-harvest activities (for example fuels treatments, tree planting and animal damage control), and other human activities can present risks to species and their habitats (see section 4.2, question 3). Some direct and indirect negative effects specifically from timber harvest include:

- Habitat loss, fragmentation, and negative edge effects.
- Habitat loss of snags and down logs
- Degradation of rare and unique communities such as those found in talus slopes, cliffs, caves, and wetlands.
- Disruption of dispersal and species migration.
- Lowered success in reproduction and rearing of young.
- Increased physiological stress for some species.
- Introduction and spread of non-native invasive species.

The effects of timber harvest are often cumulative with the effects of roads required to implement timber harvest activities (see question 4). In some cases, it is not the timber harvest itself that results in the adverse effects; the associated road system and human activities can be the primary problem. Species already threatened or at risk may be especially vulnerable to these effects.

Habitat Loss and Fragmentation

The effects of fragmentation resulting from timber harvest activities are some of the primary deleterious effects to species. Landscape fragmentation and loss of connectivity adversely affect species in several ways, including habitat loss, increases in edge effects, and increases in habitat isolation (British Columbia Ministry of Forest Research Program 1997).

Some species-specific effects of timber harvest-related habitat loss and fragmentation include:

- The northern spotted owl, a late successional forest species, has been significantly reduced in numbers because timber harvest has reduced its available habitat. Timber harvest has resulted in habitat fragmentation, which may isolate owls by reducing their ability to disperse. Timber harvest also improves habitat for spotted owl predators and competitors, thus reducing owl production and survival (Commission for Environmental Cooperation 2000).
- Marbled murrelets and spotted owl reproduction may be adversely affected because of high predation rates in fragmented forests (USDA and others 1993).
- The Louisiana black bear is threatened in part because of habitat loss from timber harvest (Commission for Environmental Cooperation 2000). Conservation objectives for the species include preserving large tracts of remaining forest and connecting large forest areas to maximize dispersal and reduce isolation.
- Traditional approaches to harvesting timber have been described as one of the primary risks to Mexican spotted owl habitat (USDI 1995). The removal of large overstory pine has resulted in fragmented habitats that can isolate this species by reducing its ability to successfully disperse.
- Ash (1997), and Petranka and others (1993) found that clearcut timber harvest eliminated some species of salamanders from the harvest area.
- Northern flying squirrels (Waters and Zabel 1995) and red-backed tree voles (Rosenburg and others 1994, Mills 1995), prey species of the northern spotted owl, occurred at lower densities in some timber harvest areas than in unmanaged forests.
- Factors identified as potential threats to the lynx included some types of timber harvest, fragmentation, and degradation of lynx refugia (USDI 1998a) Clearcuts greater than 100 m wide may create barriers to lynx movements (Ruggiero and others 1994).

- In studying fragmentation in Douglas fir forests in northwestern California, Rosenberg and Raphael (1986) found that species showing the most sensitivity to fragmentation included fisher, gray fox, spotted owl, and pileated woodpecker.

While most studies of forest fragmentation have focused on animal species, some research has addressed plants. In studying the effects of forest fragmentation from timber harvest clearcuts on *Trillium ovatum*, a common herbaceous understory plant, Jules (1998) documented continuing adverse effects (high mortality during initial disturbance and a continuing lack of new plants) even in sites that had been clearcut over 30 years ago. Although he found individual plants as old as 72 years, study areas showed few plants younger than the age of the clearcut. His study also demonstrated that populations in remaining forest remnant patches that were within 65 meters of the edge of a clearcut experienced similar adverse effects, most likely due to a combination of reduced seed set and reduced survival of seeds and seedlings near edges. He speculated that, given the severe effects from fragmentation demonstrated for this common species, it is likely that the distribution and abundance of other understory plants were similarly altered. Jules (1998) concluded that the likelihood of maintaining biodiversity would be greater in areas that have never been harvested and where landscape fragmentation has not increased.

Isolation or severely restricted size of a subpopulation due to habitat fragmentation may also have adverse effects due to the lack of genetic interchange that can lower its ability to adapt or respond to changing environmental conditions, constituting an increased long-term risk to species viability (Gilpin and Soule 1986).

Travel Barriers

Fragmentation from timber harvest can result in travel barriers. This can result in substantial amounts of suitable habitat being unavailable to these species. The examples cited by Trombulak and Frissell (2000) where land snails, rodents and reptiles avoided roads are also applicable to some timber harvest activities that increase predation or create microclimates that are unsuitable for some species. These travel barriers can fragment and isolate populations into smaller subpopulations causing demography fluctuations, inbreeding, loss of genetic variability, and local population extinctions. Amphibian species, because of their temporally and spatially dynamic populations, may be especially prone to local extinction resulting from human-caused fragmentation (Gibbs 1998). Many amphibian species are found in lower densities in some timber harvest areas when compared to mature, unmanaged forests (deMaynadier and Hunter, Jr. 1998, Petranka and others 1993, Ash 1997, deMaynadier and Hunter, Jr. 1999).

Edge Effects

Research over the past two decades has shown that habitat edge is not benign to many species (Noss and Cooperrider 1994). In terrestrial ecosystems, the edge effect of timber harvest can extend substantial distances from the harvest area. Some timber harvest introduces new edge habitat, that influences air and soil temperature, wind velocity, radiation and soil and air moisture in the adjacent forest stands (Chen and others 1995).

In addition, edge created by timber harvest can introduce edge-dwelling species of plants, birds, and animals into forest environments. For example, timber harvest into interior forest patches can lead to invasions by parasitic cowbirds and non-native invasive plants (USDA 2000). Trombulak and Frissell (2000) cite studies by Wester and Juvik (1983), Henderson and Wells (1986), Tyser and Worley (1992) and Wein and others (1992) showing that some non-native invasive plants establish themselves preferentially along roadsides and in other disturbed habitats. The establishment of these non-natives can lead to habitat loss, inter-specific competition, loss of quality forage, and lowered reproductive success for some plant and wildlife species.

Although forest edges, such as those created by timber harvest, may benefit some species, they also provide access to interior forest patches for opportunistic species, such as the brown-headed cowbird, a brood parasite that lays its eggs in the nests of other bird species, and which may adversely affect some songbird populations (Baker and Lacki 1997, Robinson and others 1995, Rosenberg and others 1999) with effects extending into forest interiors as far as 600 meters from an edge (Norse and others 1986). Cowbirds are implicated in the decline of certain songbirds in the Sierra Nevada, including the willow flycatcher (Sierra Nevada Ecosystem Project 1996).

Aquatic Species

This section of the BE discusses some of the potential effects to aquatic species from timber harvest activities other than road construction. In many cases, however, the effects of roads and other timber harvest activities are cumulative. The effects of activities associated with timber harvesting (e.g., tree felling, yarding, landings, site preparation by burning or scarification, fuels reduction, brush removal and whip felling, and forest regeneration) are often difficult to separate from the effects of roads and road building. The road systems developed to harvest timber are a significant factor affecting aquatic habitats, as discussed under question 4, above. Some of the principal effects to aquatic habitat from timber harvest can include changes in the following (Chamberlin and others 1991, Hicks and others 1991, Beschta and others 1987):

- Streamflow and the timing or magnitude of runoff events.
- Stream bank stability.
- Sediment supply and sediment storage in channels.
- Water quality
- Energy relationships involving water temperature, snowmelt and freezing.
- Habitat complexity.
- Riparian composition and function

If present, these physical changes in habitat would have may of the same biological effects as previously listed under the effects of roads, above. With the recent increased emphasis on use of best management practices and other protective measures in the design and implementation of timber harvest activities, the effects can often be mitigated to some extent. Cumulatively, however, timber harvest activities within a watershed can have pronounced and lasting effects to aquatic habitat (Chamberlin and others 1991).

Streamflow and the timing or magnitude of runoff events

Timber harvest activities can have significant effects on the hydrologic processes that determine streamflow. Timber harvests may alter the water balance within a watershed and accelerate surface flows from hillsides to stream channels (Chamberlin and others 1991). These accelerated flows can change summer base (low) flows and peak flows during rainstorms and snowmelt. Harvesting and associated site preparation practices can alter total water yield, the timing and volume of peak runoff, and the volume of summer low flows. Removal of vegetation reduces evapotranspiration, which can increase the amount of water that infiltrates the soil and ultimately reaches the stream.

Soil compaction caused by heavy equipment can decrease infiltration capabilities, increasing surface runoff. Forest management activities that substantially disturb the soil, such as yarding, burning, or road and skid trail construction, may alter both surface and subsurface pathways that transport water to streams (Murphy 1995, Thomas and others 1993). This can increase or decrease total volume of streamflows. Logging can also alter the internal soil structure. As tree roots die, soil "macropores" collapse or are filled in with sediment. These subsurface pathways are important for water transmission. When they become blocked, water is forced to the surface, increasing surface runoff and accelerating erosion.

Increased peak flow can be detrimental to aquatic species, including salmon, because the resulting bedload overturn can scour stream channels, kill incubating eggs, and displace juvenile salmon from winter cover (McNeil 1964, Tschaplinski and Hartman 1983).

Stream bank stability

Timber harvest can weaken channel banks by removing the source of large woody debris, altering the frequency of channel modifying flows, and changing sediment supply. Streambank destabilization from vegetation removal adds to sediment supply and generally results in a loss of the channel structures that promote habitat diversity required by fish populations (Forward [Harris] 1984, Scrivener 1988). Riparian tree roots provide bank stability. Streambank sloughing and erosion often increases if these trees are removed, leading to increases in sediment and loss of overhanging banks, which are important habitat for rearing Pacific salmonids (Murphy 1995) and other aquatic species.

Channels with bedrock, large tree root systems, or armor layers are more stable with respect to fluctuations in flow and sediment supply, and maintain narrower and deeper channels. But even these stable channels can be radically modified by catastrophic torrents.

Sediment supply and sediment storage in channels

Timber harvest activities that influence upland erosional processes and the way forest streams process sediment can affect the structure of fish habitats, and the structure and abundance of fish populations. These activities can directly affect sediment transport processes (Chamberlin and others 1991), and influence suspended sediment concentration. Activities that substantially change the magnitude, timing, or duration of sediment transport may overwhelm the ability of salmonids or other aquatic species to cope (Chamberlin and others 1991).

Chamberlin and others (1991) concluded that few studies have identified the component of suspended stream sediments originating from harvesting activity alone (without road influence). Some have illustrated that careful, well-planned logging can take place without appreciable sediment production (Packer 1967), whereas other have documented very high sediment levels (Reinhart and others 1963) as a result of unplanned activity. Poorly designed timber harvest skid trails are a persistent source of sediment, as are open slopes whose soils have been exposed by yarding activities (Chamberlin and others 1991).

Timber harvest activities can result in higher peak flows and increased sediment transport if the infiltration capacity of the soils is reduced from compaction. Most undisturbed forest soils can accept water much faster than normal rates of rainfall or snowfall, in a variety of ways, all related to erosion and impacts on soil structure (Chamberlin and others 1991). Slope failures following timber harvest on unstable slopes may result in increased levels of sediment (Swanson and Dyrness 1975, Ziemer and Swanston 1977, Scrivener and Brownlee 1989). Influxes of sediment from mass failures following timber harvest on unstable slopes (Swanson and Dyrness 1975, Nolan and Marron 1985) can result in the loss of pools.

Timber harvests can substantially increase the delivery of sediment to streams through surface erosion and mass wasting events. The loss of protective vegetative cover can increase splash erosion (erosion caused by raindrops detaching soil particles) and reduce slope stability. Yarding activities that cause extensive soil disturbance and compaction can increase splash erosion and channelize overland flows. Site preparation and other actions which result in the loss of the protective humic layer can increase the potential for surface erosion (Hicks and others 1991). After harvesting, root strength declines, often leading to slumps, landslides, and surface erosion (USDA and others 1993, Thomas and others 1993). The risk of this type of erosion increases 2 to 10 years after trees are cut (Burroughs and Thomas 1977, Ziemer and Swanston 1977).

A general picture of the effects of sedimentation on aquatic populations like salmon can be constructed from investigations in the Pacific Northwest. Fine sediment can directly reduce egg-to-fry survival, food production, summer rearing area, and winter survival; it can also change the morphology and stability of stream channels, causing long-term reductions in the carrying capacity of the stream and the survival of salmon in the stream (Murphy 1995). Holtby and Scrivener (1989) concluded that increased sedimentation following timber harvest reduced escapement by chum salmon (0. keta) by 25 percent in a stream in British Columbia. Cederholm and Reid (1981; cited in Murphy 1995) concluded that sediment from a debris torrent and a streamside salvage operation caused a stream in Washington to aggrade to the point at which the stream dried up during the summer. The yield of coho salmon smolt in that stream declined by 60 to more than 80 percent.

Water quality

Timber harvest may indirectly affect water quality by increasing the release of certain nutrients through the decomposition of timber harvest byproducts (leaves, branches, and other organic matter). Nutrients, such as nitrogen, phosphorous, potassium, and calcium, may increase in stream water following timber management activities. Nitrogen generally shows the most abrupt changes. Tree cutting has less effect than subsequent site preparation activities that are used to expedite regeneration (Hornbeck and Leak 1992). Elevated nutrient levels in streamflow usually return to normal in1 to 4 years (Chamberlin and others 1991).

Energy relationships involving water temperature, snowmelt and freezing

Timber harvest may cause changes in water temperature where groundwater is intercepted and brought to the surface, or where loss of tree cover in riparian areas reduces shading (Hornbeck and Leak 1992). Temperature changes may rise sharply in exposed areas then return to normal levels as water re-enters shaded areas downstream or receives cool inflow from other streams or groundwater (Pierce and others 1992). Smaller and/or shallower streams are more susceptible to temperature fluctuations than larger and/or deeper streams (Chamberlin and others 1991).

Removal of riparian canopy associated with timber harvest can elevate stream temperatures to levels which have adverse physiological effects on aquatic species, and can even result in increased mortality rates. Elevated temperatures can inhibit upstream migrations, increase disease susceptibility, reduce metabolic efficiency, and shift species assemblages (Beschta and others 1987, and Hicks and others 1991).

Habitat complexity

Hicks and others (1991) found that a primary consequence of timber harvest activities has been the simplification of fish habitat. A number of studies cited in Thomas and others (1993) have shown that simplification of aquatic habitat can occur from timber harvest activities (Bisson and Sedell 1984, Hicks and others 1991). Changes in stream flow velocities and depth (Kaufmann 1987), reductions in large wood (Bisson and others 1987, Bilby and Ward 1989), changes in interaction between streams and floodplains (Naiman and others 1992), and decreases in habitat types and substrates (Sullivan and others 1987) are examples of this habitat simplification. In Pacific Northwest streams, habitat simplification resulting from timber harvest and associated activities leads to a decrease in the diversity of the anadromous salmonid complex (Bisson and Sedell 1984, Hicks

1990). The consequence of these changes has been a reduction in the diversity and quality of habitats available to fish.

Stream habitat components can be described in terms of pools, riffles, spawning gravel, obstructions, and side channels habitat. These habitats are selectively influenced by timber harvest activities (including roads). Large woody debris is a major habitat-forming element in many streams. Reduction of wood in the channel generally reduces pool quantity and quality (Bisson and others 1987). In the broadscale assessment of aquatic species and habitats in the Columbia River Basin (Lee and others 1997), sizeable losses of both large pools and deep pools were found in streams in managed areas (multiple-use, roaded areas) over the last 50 to 60 years, compared with streams in unmanaged areas. This analysis showed that streams in 20 managed watersheds in some Central Idaho Mountains had a 40% decrease in the frequency of large pools, whereas large pools in 11 unmanaged streams in the same area showed no noteworthy change. A substantial decrease was also found in the frequency of deep pools in managed streams in this area, in contrast with a considerable increase found in streams in unmanaged areas.

Riparian zone composition and function

The importance of riparian zones on aquatic habitats has been well documented (Gregory and others 1991, Naiman and others 1992, Thomas and others 1993, Bury and others 1991). The potential relationships between timber harvest and riparian management have been addressed in many recent management guidelines (Thomas and others 1993, USDA 1994, USDI 1998b). Timber harvest can affect riparian vegetation through removal, soil compaction, changes in drainage patterns and floodplain function, and introduction of non-native invasive plant species.

Riparian vegetation is a controlling factor of stream habitat quality, particularly in smaller streams. It contributes organic materials that supply nutrients and affect productivity, insects that serve as a food source, and logs and branches that affect channel morphology. Riparian vegetation retains organic matter, and provides cover for fish. Roots stabilize stream banks and maintain undercut banks. The protective canopy provided by riparian vegetation helps regulate temperature by shading the channel in summer and insulating from heat loss in winter (Murphy and Meehan 1991). Increased water temperature can often be traced to removal of shade-producing riparian vegetation along fish-bearing streams and along stream tributary streams that supply cold water to fish bearing streams (Beschta and others 1987, Bisson and others 1987). Removal of streambank vegetation has resulted largely from timber harvest in riparian areas (Beschta and others 1987).

General effects of timber harvest to aquatic species

In general, even though designed to meet forest plan standards and guidelines, timber harvest activities can have adverse direct, indirect and cumulative effects on aquatic habitat, with the degree of effect influenced by the type, location, extent, and duration of the activity, and the effectiveness of mitigation measures applied. Identified adverse impacts can include changes in watershed hydrology and streamflow, degradation of water quality relative to temperature, suspended sediment, dissolved oxygen, nutrients, release of toxic chemicals such as petroleum products, and changes in important physical habitat attributes such as substrate composition, instream woody debris, bank stability, and riparian vegetation. (Meehan ed. 1991)

Thomas and others (1993) found that quantitative relationships between long term trends in the abundance of fish and fish habitats and the effect of forest management practices (including timber harvest) were difficult to establish. Because of inherent differences in stream size, storm magnitude, and geology, similar management practices may result in difference responses. In addition, the effects of timber harvesting on aquatic ecosystems can extend well beyond those areas directly impacted, given the influence that upslope areas and upstream reaches have on condition of downstream habitat (Chamberlin and others 1991).

Recent work by Hicks (1990) and Bilby and Ward (1991) suggest that habitat is slow to recover to pre-harvest levels of complexity. Schwartz (1991) found that cutthroat trout populations in streams with coho salmon failed to recover from pre-timber harvest levels 25 years after harvest. Yount and Niemi (1990) classified timber harvest as a “press disturbance” suggesting that species may not recover to pre-disturbance states, due to the loss or alteration of functions and processes affecting systems. Habitat degradation from timber harvest was identified as a factor in the regional decline and loss of populations of some inland cutthroat trout subspecies, including westslope, Rio Grande, Bonneville and Yellowstone cutthroat trout (Young ed., 1995, Duff ed. 1996).

Conclusion

Given the numbers, diversity, and distribution of TEPS species that have habitat within the area affected by the proposal, a prohibition on timber harvest would provide important national conservation for these species and their habitats, given the exception in prohibition Alternative 4 that would permit timber harvest if essential for recovery or protection of a threatened or endangered species. Overall, effects to conservation of TEPS species would be beneficial.

(6) What proposed, threatened, endangered, or sensitive species or designated critical habitat may be adversely affected by the prohibition of road construction, road reconstruction and/or timber harvest?

The BE effects determinations were based on forest and regional biologist evaluations of which TEPS species and associated critical or essential habitats would likely to be directly or indirectly impacted by inventoried roadless areas, and whether the potential effects from the prohibition on road construction/reconstruction or timber harvest could be significant for any TEPS species. Roadless Conservation Project EIS team biologists contacted the nine Forest Service regional program leaders for threatened, endangered and sensitive species, and associated regional specialists. Each regional TEPS species list was reviewed, with regional personnel asked to identify any species which might be adversely affected by a prohibition on road construction or timber harvest in inventoried roadless areas. In addition, current scientific literature on the potential effects of road construction and timber harvest activities was reviewed.

Based on the reviews conducted by the regions, and the reviews of current literature, we have concluded that prohibitions on road construction, road reconstruction and timber harvest proposed in the prohibition action alternatives, and the Tongass alternatives, may affect, but are not likely to adversely affect threatened or endangered species or adversely modify designated critical habitat. They are not likely to jeopardize proposed species or adversely modify proposed critical habitat. In addition, they may impact individuals, but are not likely to cause a trend towards federal listing or a loss of viability for any sensitive species. The potential benefits to TEPS species are discussed under questions 4 and 5, above. The potential for adverse effects are discussed below.

Prohibition on road construction and reconstruction

No adverse effects to TEPS species from a prohibition on road construction and reconstruction in inventoried roadless areas were identified. Overall, the need for additional road construction or reconstruction to manage TEPS species or habitat within inventoried roadless area appears to be minimal. The current national capability of the Forest Service and of other agencies with jurisdictional responsibilties to manage species or habitat within these areas would not be measurably affected by such a prohibition. None of the alternatives would reduce existing access. The agency would retain the tools necessary to manage these resources.

A forest-level review of conservation strategies for sensitive species revealed no projects planned through 2004 within inventoried roadless areas that would require road construction or reconstruction. Only one project requiring road construction into an inventoried roadless area was identified for recovery of a threatened or endangered species, involving stream barrier construction in the Southwest Region to prevent movement of non-native fish species into habitat occupied by threatened loach minnow and Apache trout, as well as other native fish species. As currently designed, it would require 2 miles of temporary road construction in an inventoried roadless area. A feasibility study for this project presented two alternatives that would not require road construction: using a site 8 miles upstream with current road access at a 20% cost savings, or using helicopter access to a site about 3 miles upstream at an 18% increased cost (U.S. Bureau of Reclamation 1998*)*. This project could, therefore, still be implemented.

Based, then, on the information provided by each national forest, the current need for road construction or reconstruction within inventoried roadless areas for recovery or protection of threatened, endangered or sensitive species appears to be minimal. There is no reason to expect that this would change in the upcoming decades. It is unlikely that alternate means of access could not be found to accomplish recovery or conservation objectives, although costs may increase in some situations. With the exception provided under all of the prohibition alternatives that an existing road may be realigned to prevent irreparable resource damage, adverse effects to TEPS and other species caused by existing roads may be mitigated.

Prohibition on timber harvest

An important objective of this evaluation was to determine whether the prohibition on timber harvest in inventoried roadless areas under Alternative 4 would reduce the ability of agency to manage fuels, which could result in an increased incidence of uncharacteristically large, stand-replacing wildfires; and if so, to determine the implications to TEPS species. To address these questions, it is was necessary to address the following questions:

- What is the need for significant fuel load reductions within inventoried roadless areas?
- What are the potential effects of fire on terrestrial and aquatic species?
- How effective are efforts to mechanically reduce fuel loading at the stand and landscape levels?
- What is the likelihood of achieving significant fuel load reductions within inventoried roadless areas through timber harvest?
- Given the above, are there discernible differences between the prohibition alternatives relative to effects from different levels of timber harvest?

With the exception available for timber harvest needed for recovery or conservation of TEP species, Alternative 4 would not preclude use of timber harvest for stand enhancement, successional stage management, or fuels reduction for those species, provided the applicable federal agency with ESA oversight responsibilities concurs. As there is essentially, then, no prohibition of timber harvest relative to these species that would preclude activities needed for recovery or conservation, none of the action alternatives would pose an increased risk of adverse effects, relative to the environmental baseline.

Without the exception available for timber harvest needed for conservation of sensitive species, Alternative 4 would preclude use of timber harvest for stand enhancement, successional stage management, or fuels reduction that may be desirable for some sensitive species. The following discussion, therefore, focuses on sensitive species.

Effects of fires on terrestrial and aquatic ecosystems

It has become increasingly apparent that, in certain parts of the country, some types of past timber harvest, combined with the effectiveness of past wildfire suppression over the past century, have caused significant ecological shifts in vegetation composition and structure, resulting in altered fire regimes in some vegetation types by increasing fuel loads and flammability. In addition, these changes in vegetation have resulted in habitat losses for species requiring open old-growth and early seral stages (Smith 2000). Conversely, habitat for some species preferring multi-storied forested habitats has been enhanced in some areas.

Response activities for fire suppression in inventoried roadless areas have likely been more limited in the past, due in part to a lower priority being placed on rapid suppression of fires in these areas, relative to fires in roaded and more developed areas. Many of these areas have also had lower levels of commodity timber harvest which can remove larger and more fire resistant trees, leaving smaller diameter, less fire resistant stems. Stand conditions within these areas, therefore, may lie within or closer to the historic range of variability, with more normal levels of fuel loading and stand composition and structure. The precise condition of these areas relative to risk of catastrophic fire has not been determined, but analysis made for the FEIS using state level data provided an estimate that approximately 8 million acres, or 14%, of inventoried roadless areas may be at high risk of catastrophic fire. This compares to an estimate of 38 million acres or 20% of all NFS lands estimated to be at high risk. Further discussion relative to regional levels of risk can be found in Chapter 3 of the FEIS.

For many terrestrial and aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many terrestrial and aquatic species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. For example, wildfires that create habitat mosaics can improve foraging habitat for lynx (USDA and others 2000a). While these disturbance events may have negatively affected individuals of some TEPS populations, the overall effects on species population viability are less likely to have been adverse in nature. Intense stand-replacement wildfires can result in direct mortality or local loss of suitable habitat for species like the Mexican spotted owl (USDI 1995).

Overall, the effects of wildfires on terrestrial and aquatic species can vary depending on fire occurrence, intensity, severity, uniformity, size and season. The effects of fire may be both direct and immediate, as well as indirect and sustained over an extended period (Minshall and others 1989, Niemi and others 1990, Smith 2000). Species with limited ranges or low population numbers may be especially vulnerable. Smith and Fischer (1997) suggested that fire may threaten a population that is already small if the species is limited in range and mobility or has specialized reproductive habits. Conversely, other species with larger home ranges and relatively stable population numbers may benefit for the creation of habitat mosaics.

Effects of wildfires on terrestrial animals

The ability of individuals of a species to survive the direct effects of fire depends on their mobility and on the uniformity, severity, size and duration of fire. While fires have the potential to injure and kill animals caught in their path (Bendell 1974, Singer and

Schullery 1989), they generally kill and injure a relatively small proportion of animal populations (Smith 2000). Many adult vertebrate species are mobile enough to flee burning areas or seek refuge. The young of the year are often most vulnerable to injury and mortality from fire (Smith 2000).

Though many species may leave a burning area, some return or live on the edges to take advantage of exposed prey and other food sources. Other species abandon burned areas because the habitat no longer provides the structure or foods that they require to survive or reproduce, and do not return until suitable habitat develops over time (Smith 2000).

At a landscape level, fires create and maintain habitat mosaics of different kinds of vegetation (Mushinsky and Gibson 1991). This includes size, composition, and structure of patches, as well as connectivity among patches. Smith (2000) identified the following landscape scale fire effects on fauna: (1) changes availability of habitat patches and heterogeneity within them, (2) changes in the compositions and structures of larger areas, such as watersheds, which provide the spatial context for habitat patches, and (3) changes in connection among patches. During the course of postfire succession, all three of these landscape features are in flux.

The following are some examples of animal behavior in response to direct fire effects and changes in habitat:

Birds

- In forested areas, fire effects on birds depend largely on fire severity. The young of birds nesting on the ground and low vegetation are vulnerable even to understory fire during nesting season. Intense surface and crown fires could injure species nesting in the canopy, but this kind of fire behavior is more common in late summer and fall than during the nesting season.
- Some raptor species took advantage of large mammal carcasses in the Yellowstone fires (French and French 1996);
- Dodd (1998) reported beneficial effects to northern goshawk and sharp-shinned hawks in ponderosa pine forests probably because of reduced hiding cover and exposed prey populations.
- Bevis and others (1997) found that spotted owls in south-central Washington, though continuing to use areas burned by understory fire, avoided stand-replacement burns, probably because their prey had been reduced.
- Although stand-replacing fire in Douglas-fir forests in western Montana favored birds that feed on insects, at least one insect feeder, Swainson’s thrush, abandoned a burn immediately (Lyon and Marzluff 1985), probably due to its need for cover.
- Many species of woodpeckers show substantial population increases and disperse into areas burned by stand-replacing fire (Hejl and McFadzen 1998, Saab and Dudley 1998, Hutto).
- Some species like the northern goshawk and flammulated owl benefit from fine-scaled landscape patterns of intermixed early, mid and late seral patches, and the

connectivity between these patches. Fires that increase or maintain heterogeneity, and maintain connectivity may benefit these species. Conversely, fires that create large areas of homogeneous forest structure and reduce connectivity also reduce habitat quality and habitat availability for these species.

Mammals

- Direct fire-caused mortality has been reported for large as well as small mammals including coyote, deer, elk, bison, black bear and moose (French and French 1996, Gasaway and DuBois 1985, Hines 1973, Kramp and others 1983, Oliver and others 1998).
- Singer and Schullery (1989) reported that most large mammals in the Yellowstone fires simply moved away from danger during fires, while others died primarily from smoke inhalation.
- French and French (1996) concluded that because mortality rates of large mammals are low, direct fire-caused mortality has little influence on populations of these species as a whole.
- Small mammal mortality can be more severe because some species construct surface-level nests made of dry, flammable materials (Kaufman and others 1988, Quin 1979, Simons 1991). However, many small mammals avoid fire by outrunning fires or using underground tunnels and nonflammable habitats of talus, soil and rock. The young of small mammals are especially vulnerable to fires, but most of these species also have high reproductive rates; if post-fire habitat provides food and shelter for them, their populations recover rapidly (Smith 2000).
- Like birds, mammals respond directly to fire-caused changes in cover and food. For example, many small mammals such as rabbits, snowshoe hare, red squirrel, northern flying squirrel, and voles generally avoid recent stand replacement burns (Ream 1981) probably because of lack of security and cover. Other mammals use burned areas preferentially, and some use them seasonally or as part of their home range (Smith 2000).
- Large carnivores and omnivores are opportunistic species with large home ranges. Their populations change little in response to fire, but they tend to thrive in areas where their preferred prey or forage is most plentiful - often, in recent burns.
- Fire has been recommended for improving black bear (Landers 1987) and grizzly bear (Hamer 1995, Morgan and others 1994) habitat.
- While large-stand-replacement fires generally do not favor marten, mixed-severity fires in lodgepole pine, spruce and fire in northern Idaho left a mosaic of forest types that supported a diversity of cover and food types favorable for marten (Koehler and Hornocker 1977).

Amphibians and Reptiles

- Information on fire effects on amphibians and reptiles is limited. Mortality of reptiles and amphibians probably occurs, but according to a review by Russell and others (1999), there are few reports of fire-caused injury to these species groups.

- Many reptiles and amphibians live in mesic habitats that are likely to burn less often and less severely than upland sites (Smith 2000). Nevertheless, fire-caused changes in plant species composition and habitat structure (for example woody debris and down logs) influence reptile and amphibian populations (Means and Campbell 1981; Russell and others 1999).
- Amphibians in forested areas are closely tied to debris quantities – the litter and woody material that accumulate slowly in the decades and centuries after stand replacing fire (Smith 2000) and reductions in debris can influence their populations. For example, Bunnell (1995) in forests of British Columbia found that the proportion of non-mammalian vertebrates (mainly amphibians) using woody debris was positively correlated with the length of fire rotation.

Effects of wildfires on terrestrial plants

Information concerning fire effects on specific sensitive plants is limited. A majority of sensitive plants are vascular plants, many of which share similar mechanisms for surviving and recovering from fires. Generally, the impact of fire on plants depends on the severity of the fire, the inherent resistance of a species, and its ability to recover (Brown and others unpublished). While fires may kill some sensitive plants, others plants simply lose the above-ground portion of the plant and resprout. When plants are killed, the ability of seed in the seedbank or of seed dispersed into the site to germinate depends on whether a favorable environment exists for seedling establishment. The following information relative to plant recovery and seedling establishment was summarized by Brown and others (unpublished) in *Effects of Fire on Flora*:

- Whether herbaceous plants recover after fire depends largely on whether their regenerative structures (stolons and taproots) are exposed to lethal temperatures (Brown and others unpublished).
- Perennial grasses may be killed if fire burns meristems and buds.
- Post-fire species composition is usually an assemblage of many of the species that were growing on the site and were represented in the seedbank at the time of the fire (Brown and others unpublished). There may be enormous reserves of seed in the seedbank.
- Seedling establishment is affected by the amount of seed present and conditions required to induce germination. Seed supply of various species and inherent seed longevity both affect the numbers of viable seeds in the seedbank.
- In ponderosa pine communities, viable seeds of most grass and annual forbs species were found mostly in the litter layer, indicating short term longevity and short seed dispersal, while seeds of perennial forbs species were found mostly in mineral soil, and were probably fairly long-lived (Pratt and others 1984).
- Seeds for some species persist in the soil for years after dispersal. For example, pincherry and snowbrush ceanothus seeds can remain viable for 100 to 300 years, respectively (Whittle and others 1997, Noste and Bushey 1987).
- Some perennial forbs resprout after fire, flower, and produce abundant seeds that establish in the second and subsequent postfire years (Keeley 1998). Some

species that establish from seed may be temporarily eliminated from a burn area because the postfire environment does not favor their establishment.

- For most species that develop from seeds dispersed after fire, the best seedbeds are microsites where most or the entire organic layer has been removed by fire because they provide the greatest chance for seedling survival (Brown and others unpublished). For seedlings that require shade, establishment does not occur until the canopy closes and deep litter layers form.

The same fire-induced site condition changes that affect native plant compositions also determine the composition of non-native invasive plants. The establishment of these plants can lead to habitat loss and lowered reproductive success for some plant and wildlife species.

Fires can serve as a means of entry for many non-native invasive plant species. Many of these plant species are associated with disturbances and can easily proliferate in burned areas. Exotic plants are often among the first species to arrive and colonize areas where the soil surface has been disturbed or where plant cover is lacking (USDA 2000). Exotic plants that have an opportunistic colonizing life history (colonizers) are typically prolific producers of seed (or other reproductive parts such as rhizomes) and often are adapted to long-distance dispersal by vehicles, wind, wildlife, livestock, water or machinery (USDA 2000). They usually germinate under a wide variety of conditions, establish quickly, grow fast, and out-compete native species for water and nutrients

Aggressive non-native invasive plant species tend to undermine native plant diversity through competition and habitat alteration. For example, the Sierra Nevada, an area historically rich in plant diversity with over 3,500 native species, now supports hundreds of non-native species, many of which have had considerable detrimental ecological effects (Sierra Nevada Ecosystem Project 1996). Other parts of the country show similar situations. Areas infested with invasive species such as spotted knapweed and leafy spurge have been found to have much lower productivity of grasses (Hillis 1999). Once established, many of these species are extremely difficult to eradicate. The use of herbicides associated with control efforts can have unintended adverse effects to populations of other terrestrial and aquatic species (Norris and others 1991).

Effects of fires on aquatic systems

For many aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Fire-killed trees provide an important and continuing supply of large woody debris to many aquatic systems, which is an important habitat attribute essential for many salmonid and other aquatic species. Many aquatic species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events.

Fire-related mortality of fish and aquatic invertebrates has been reported in a number of studies (Cushing and Olson 1963, Hall and Lantz 1969, Minshall and others 1997). According to Gresswell (1999), fire-related fish mortalities are generally associated with more intense and severe fires. Several of the potential causes were described in Gresswell (1999):

- Fire-induced changes in stream pH, ash extracts and smoke gases can be lethal to aquatic organisms (Woodward 1989, Cushing and Olson 1963, Spencer and Hauer 1991).
- In some cases, water temperature apparently reached lethal levels, but this was generally not associated with third-order [or larger] streams (Minshall and others 1989).
- Minshall and others (1989) speculated that chemical toxicity from smoke or ash would not cause fish mortality in second and third-order streams.

Minshall and Brock (1991) reported dead salmonids in three small streams in Yellowstone following the fires of 1988, but concluded that the simultaneous occurrence of live fish in these streams suggested that mortality was not uniform or that surviving individuals migrated into these streams soon after the fire. Research on the Boise National Forest following large intense fires in 1992 showed rapid recolonization of Boise river stream reaches by bull trout and redband trout (Rieman and others 1997). By 1995, fish densities were greater in the burned sections than in similar sections that did not burn. Research on recolonizaton of fish populations after large disturbance events or experimental removal indicates that full population recovery can occur quickly, frequently within a few years (Niemi and others 1990, Detenbeck and others 1992), or in appreciably shorter periods (Sheldon and Meffe 1995, Peterson and Bailey 1993).

Although Rieman and others (1997) documented that large fires can adversely affect aquatic systems, and can result in fish mortality and even extirpation, they concluded that the resilience and persistence of salmonid populations are heavily influenced by the complexity and spatial diversity of habitats. A complex, well-dispersed network of habitats is likely to be an important element in the persistence of fish populations during and after large fires. They conclude that some aquatic species, such as bull trout and redband trout, appear to be well-adapted to "pulsed" disturbances such as fire and its associated hydrologic effects, as opposed to more continual or "press" effects linked to roads and extended timber harvest. They recommend that, where small or isolated sensitive fish populations occur in watersheds at high risk of uncharacteristic wildfire, management actions should be implemented only after careful site-specific evaluations of the risks.

Gresswell (1999) concluded that current evidence suggests that even in the case of extensive high-severity fires, local extirpation of fishes is patchy, and recolonization is rapid. Lasting detrimental effects on fish populations have been limited to areas where native fish populations have declined and become increasingly isolated because of human activities. Burns (2000) found that risks to fish populations from fire, either prescribed or wildfire, are low where fish populations can freely migrate and ecosystems are not severely fragmented. Furthermore, Gresswell (1999) cites Warren and Liss (1980), Sedell and others (1990), and Reiman and others (1997) in concluding that native fishes have developed a complex variety of life history strategies that increase the probability of persistence during periods of environmental fluctuation. Even in cases where fish are extirpated, reinvasion is rapid if habitat connectivity is maintained.

Gresswell (1999), upon reviewing the literature on physical responses to fire in forested watersheds, concluded that most temporally intermediate effects of fire on aquatic organisms are related to hydrologic change from increased water yield and sediment routing. Hydrologic processes control channel morphology, sediment composition and concentration, and recruitment and distribution of large woody debris.

Erosional effects are most extreme where the majority of vegetation and duff has been consumed by fire, soils are highly erosive, and large precipitation events occur after fire (Gresswell 1999). In highly erosive or unstable landscapes in the west, 30 to 70 percent of the long-term sediment yield occurred during and immediately following fires. Conversely, the Appalachian Mountains fire-induced sediment yields dropped to approximately 5 percent. Gresswell (1999) concluded that in watersheds that are prone to erosion, the primary effect of a single fire may be a short-term alteration of hydrological and erosional processes. Everest and others (1987) and Reeves and others (1995) concluded that post-fire erosion events are important in maintaining long-term habitat complexity and suitable spawning and rearing habitats. Furthermore, because the proportion of a watershed that is burned influences the magnitude and extent of the post-fire changes, smaller drainages in headwater areas often exhibit the greatest fire-related alterations. Brown and Krygier (1971), Swanston (1971) and Swanston and Swanson (1976) concluded that anthropogenic activities can exacerbate the effects of natural events such as fire. In many cases, erosion at a watershed scale is more closely linked to timber harvest and road construction than fire.

The effects on fire-induced woody debris recruitment can last for decades. Therefore, the rate of pool formation usually increases, and habitat structure may be altered with beneficial effects to fish. Excessive abundance can block fish passage, cover important spawning sites, and damage habitat during post-fire flood events (Swanston 1991). Over longer periods, however, benefits of fire-related debris recruitment probably outweigh the negative effects (Swanson and others 1982, Reeves and others 1995).

Water temperatures are elevated when fire reduces or removes streamside vegetation. Elevated temperatures may alter abundance, species diversity, egg incubation, and offspring survival (Betschta and others 1987, Reeves and others 1993). Conversely, in areas where low water temperatures limit primary production, elevated water temperatures (nonlethal) following canopy burning may actually increase productivity (Albin 1979, Minshall and others 1989).

Potential effects of five year timber program on wildfires

The potential effect of planned timber harvest offer for fiscal years 2000-2004 on acres of moderate to high fire hazard inventoried roadless areas is described in the FEIS, Chapter 3. The FEIS provided a rough estimate that for every 7,000 board feet of timber harvest, one acre of land would have a reduction in fire hazard, with the actual level of fire hazard reduction dependent on the type of treatment and post-harvest fuels management. Using this projection, the DEIS estimates that, over the next five years, approximately 94,000 acres of inventoried roadless areas nationwide (excluding Alaska) could have reduced fire risk as a result of the level of planned harvest offer under the no action alternative. This is less that 1% of all inventoried roadless areas lands that potentially could need fuel treatment. It is also important to note that the actual offer is frequently significantly less than the planned offer, so this acreage would likely be lower.

The implementation of the proposed fiscal year 2000-2004 timber harvest program in inventoried roadless areas would, therefore, have an insignificant effect on reducing risk of catastrophic fire in inventoried roadless areas. Accelerated levels of harvest in inventoried roadless, if proposed, could result in potential tradeoffs to sensitive species, from the adverse effects associated with timber harvest and associated transportation systems, as described in questions (4) and (5) above.

It is also important to recognize that there is a pronounced lack of research addressing the feasibility, effectiveness, and ecological legacies of landscape level fuels reduction efforts. It is not currently prudent, with any strong scientific basis, to predict the effectiveness of such treatments in reducing overall level of risk of large-scale stand-replacing events, or of accurately assessing the potential adverse ecological effects which may result from such large-scale efforts.

As described in the FEIS, Chapter 3, the analysis conducted by the fire specialist on the EIS team showed that there would be minimal landscape level differences between prohibition alternatives, relative to the likelihood of timber harvest causing significant reduction in catastrophic fire risk.

It is also likely that fuel reduction in most of these areas would not receive a strong emphasis, at least within the next decade, even under the no action alternative, as the priorities for this type of treatment would likely remain in areas where there is a risk to life and property.

Conclusion

The action alternatives, while substantially reducing the amount of timber harvest, do not preclude all timber harvest activities, except in alternative 4. This alternative, though, would allow timber cutting that was needed to recover or conserve TEP species. It is likely that timber cutting designed to benefit TEP species could have beneficial effects to sensitive species. For example, stand-opening treatments to maintain endangered Red-cockaded woodpecker could benefit Bachman's sparrow, Florida mouse, Florida burrowing owl, southeastern, American kestrel, gopher tortoise and Ozark chinquapin (USDA 1995a). Restorative timber harvest for the Mexican spotted owl could benefit northern goshawk and flammulated owls. In addition, none of the alternatives, including Alternative 4, would preclude use of other restorative tools like prescribed fire, which under some conditions can be used without prior timber removal, to benefit early seral and open forest sensitive species.

Overall, the current need for timber harvest specifically to manage sensitive species habitat within inventoried roadless area appears to be minimal. The current national capability of the agency to manage sensitive species habitat would not be measurably affected by any of the action alternatives. Timber cutting to reduce fuel loading may be desirable in some areas where there is an abnormally high risk of high intensity, large-scale fires. Fuels reduction stewardship activities may be beneficial to some aquatic and terrestrial populations, if such activities are implemented with minimal impacts to habitats. Uncertainties about the magnitude and extent of beneficial effects of such activities would need to be carefully weighed against the well-documented risks of adverse effects associated with timber harvest and associated road construction.

In evaluating the potential need for fuels reduction efforts for conservation of sensitive species, it is important to recognize that, for many terrestrial and aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many terrestrial and aquatic species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. For example, wildland fires that create habitat mosaics can improve foraging habitat for lynx (USDA and others 2000). Fire-killed trees provide an important and continuing supply of large woody debris to many aquatic systems, which is an essential habitat feature for many salmonid and other aquatic species. While such disturbance events may have negatively affected individuals of some TEPS populations, the overall effects on species population viability are less likely to have been adverse in nature.

The effects of wildland fires on terrestrial and aquatic species can vary depending on fire occurrence, intensity, severity, uniformity, size, and season. The effects of fire may be both direct and immediate, as well as indirect and sustained over an extended period (Minshall and others 1989; Niemi and others 1990; Smith 2000). Some impacts may result in short term habitat loss, but long-term habitat enhancement. For example, fires may destroy some northern goshawk nest sites. However, these same fires may also create the habitat mosaics that enhance goshawk habitat. Species with limited ranges or low population numbers may be more vulnerable. For example, adverse effects to fish populations have been limited to areas where native fish populations have declined and become increasingly isolated because of human activities (Gresswell 1999).

The analysis in the FEIS showed that some types of past timber harvest and the effectiveness of past wildland fire suppression have caused significant ecological shifts in vegetation, fuel loading, and fire regimes in some areas, increasing the risk of high-intensity, large-scale, stand-replacing fires in many areas. However, as discussed in the Fuel Management section in the FEIS, Chapter 3, there appear to be minimal landscape level differences between alternatives, relative to the likelihood of timber harvest providing significant reduction in the risk of uncharacteristic wildland fire effects in inventoried roadless areas, at projected harvest levels. There is also a lack of current scientific literature addressing the feasibility, effectiveness, and ecological legacies of landscape-level fuels reduction efforts.

Regardless of the alternative selected, wildland fires of increased severity and size will continue to impact habitat for some species. While wildland fires may negatively affect individuals in some TEPS populations, the overall effects on population viability are less likely to be adverse in nature. None of the alternatives would preclude the use of other restorative tools like prescribed fire, which under some conditions can be used without prior thinning, to benefit early seral and open forest species.

4.3 Effects of Social and Economic Mitigations on Biodiversity Common to Alternatives 2, 3, and 4:

Several social and economic mitigation measures, in the form of exceptions to the prohibition on road construction and reconstruction in Alternatives 2, 3, and 4, were developed as a result of public comment on the DEIS. If selected as part of the final rule, these exceptions would allow the responsible official to authorize road reconstruction for public health and safety purposes, and road construction or reconstruction for Federal Aid Highway projects or permitted mineral leasing activities.

It is important to note that these exceptions in themselves would not authorize any activities, such as leasable mineral extraction, but rather would waive the prohibition on road construction or reconstruction for permitted activities in the specified categories. Rather than being automatically granted, proposals under these exceptions would have to meet certain conditions in order to be authorized, to assure that impacts to roadless characteristics are minimized, as described in Chapter 2 of the FEIS.

As is currently the case, all road construction or reconstruction projects, and the activities associated with them, would be subject to the requirements of applicable statutes and regulations, including the National Environmental Policy Act and the applicable land management plan standards and guidelines. Any projects that may affect threatened or endangered species would be subject to the consultation requirements of the Endangered Species Act.

These exceptions would decrease the number of miles of road construction and reconstruction that would be precluded over the next five years by 76 miles (none of which would be on the Tongass). This would therefore increase the miles, which would likely go forward to 369 (673 miles with the Tongass exemption) for Alternatives 2, 3, and 4. The effects of road construction associated with these exceptions would be similar to those previously described and is included under Alternative 1. The beneficial effects related to the prohibition on road construction under Alternatives 2, 3 and 4 would therefore be somewhat less than previously described, given the greater number of road miles that would likely be constructed, and the effects of the activities associated with those roads.

There is no way to predict the amount or location of road reconstruction that would be excepted for reasons of public health and safety. Realignment or upgrade of roads would likely result in additional ground disturbance but it is unlikely that the environmental effects of such reconstruction would substantially expand the area affected beyond that of the original construction, especially given the current emphasis on environmentally sensitive design and use of best management practices. Such reconstruction could, however, result in substantial changes in the kinds and amount of human uses in an area with associated potential adverse effects on biodiversity as previously described. Provided that conservation of other roadless characteristics is given strong emphasis in the project design and mitigation, this reconstruction would not be likely to result in additional substantial long-term ecological changes.

Estimates of the miles of road construction which may be excepted for Federal Aid Highway projects over the next five years indicate that few additional miles would likely be constructed in inventoried roadless areas. There is no reason to anticipate a substantial increase in the future. Only one 6-mile project is currently planned on the Chugach National Forest. While this project may have local effects on the characteristics and values associated with the affected inventoried roadless area, this limited level of activity would not result in a substantial change in the overall environmental effects of the alternatives.

As currently projected for the next five years, requests for new leasable mineral activities in inventoried roadless areas are expected on six national forests, requiring an estimated 59 miles of road construction. Undoubtedly there would be additional activities on other forests in the future, in response to changing economic conditions and shifts in supply and demand for these resources. The types of activities that would be eligible under this exception include exploration and development of geothermal, oil and gas, coal, and phosphate resources.

There appears to be limited potential in the near future for geothermal development activity associated with inventoried roadless areas, based on data submitted by the national forests and grasslands. Only one forest anticipated lease applications in the next five years, with three miles of associated temporary road construction. Although the magnitude of effects from geothermal exploration and development would be dependent on a variety of factors, impacts from such activities do not currently appear to pose substantial or widespread risks to biodiversity. Geothermal exploration activity in many areas has been restricted in extent, and has often resulted in little disturbance to areas around drilling sites. As the location of drilling sites for exploration is often somewhat flexible, environmentally sensitive areas usually can be avoided (USDA and USDI 1994).

Oil and gas exploration and development activity within inventoried roadless areas is anticipated on four national forests in the next five years, with an associated 34 miles of road construction. It appears that nationally, the demand for these resources is increasing. Therefore, there may be increases in the level of this kind of activity within inventoried roadless areas on these four forests and other NFS lands. The associated road systems would likely account for a substantial portion of potential environmental effects, including increased risk of spread and establishment of non-native plant species. Other effects of these activities would be determined by the location and size of areas disturbed, the duration of the activity, mitigation measures used for environmental protection including containment of toxic materials used in the drilling process, the type and effectiveness of site reclamation, and the overall level of exploration and development activity within an area.

Ten projects on two national forests were identified which would involve exploration or development of coal or phosphate resources, with an estimated 22 miles of road construction. These kinds of activities can have adverse effects to both aquatic and terrestrial species, some of which can be substantial and long term.

Many of the principal effects to biodiversity from mining are to aquatic systems. The potential hydrologic effects of mining, such as changes in timing and volume of runoff and alterations of water quality, depend in part on the size of the area affected, and the effectiveness of runoff and pollution control measures. While historically, the environmental effects of these kinds of activities have often been substantial, best management practices are now being incorporated in project designs to moderate effects to the extent feasible, and ongoing monitoring is conducted to insure early detection of potential mitigation failure.

Although any mining activity may have negative effects on aquatic ecosystems, the largest impacts have generally been associated with surface mining. Surface mining activities can have a number of adverse effects to aquatic systems including changes in the timing and magnitude of runoff and stream flows, accelerated erosion and substantial increases in sedimentation, contamination of water with metals, acids or other toxic substances, and increased bank and streambed instability. Surface mining can also affect aquatic habitats by removing riparian vegetation and physically altering or encroaching on the stream channel (Lee and others 1997).

In general, surface mining causes higher stream flows and greater storm flow volumes than underground mining due to a greater amount of surface area disturbance with associated removal of vegetation and topsoil, greater amounts of spoils, and general compaction of the area (Southern Appalachian Man and the Biosphere 1996c). While stream channels can adjust to increased flows and sediment loads, such alterations can have adverse effects on the quality of aquatic habitat.

Coarse sediments delivered to channels are likely to be deposited relatively quickly, affecting nearby aquatic habitat. Finer materials settle out more slowly and may create turbid water conditions for long distances downstream, affecting primary production and biomass by reducing the amount of light available to algae and rooted aquatic plants. (Lee and others 1997). Increases in turbidity can cause direct mortality to aquatic species, reduce growth and feeding activity (Nelson and others 1991), and can affect the abundance and diversity of benthic invertebrates (Lee and others 1997). Excessive fine sediment deposition in stream substrates can degrade spawning habitat for salmonids, and eliminate habitat for some bottom dwelling aquatic species by filling in spaces in gravels. (Nelson and others 1991).

Acidification of surface waters can affect aquatic species by lowering pH to sub-lethal or lethal levels, mobilizing toxic metals, and forming noxious ferric hydroxide precipitates commonly called "yellow boy" (Nelson and others 1991). The effects of low pH can include direct mortality, reduced growth rates, reproductive failure, skeletal deformities, and increased uptake of toxic metals. The early life stages of many aquatic species, including mollusks and fish, are often more sensitive to toxic metal contamination than are adult stages. Acidification can affect biodiversity by eliminating species sensitive to low pH and favoring the proliferation of those species that have a greater tolerance. It can also reduce overall population density and total biomass. (Nelson and others 1991).

Some mining activities can result in adverse effects to terrestrial species. Mining activities can fragment and degrade habitats, and disrupt, disturb and or displace some species. Mitigation measures are often developed to moderate these adverse effects. In some cases, these can be short-term adverse effects that end when the activities are discontinued. Conversely, these activities can result in long term adverse effects if activities persist for extended periods or occur during critical life-cycle periods. The Grizzly Bear Recovery Plan (USDI 1993) encourages consideration of grizzly bear habitat needs and phasing-in of road density guidelines to make mining exploration and development compatible with bear habitat requirements. The Lynx Conservation Assessment and Strategy (USDA and others 2000) identified several risk factors from mineral developments. The strategy states "most of these activities affect lynx habitat by changing or eliminating native vegetation, and may also contribute to fragmentation". The primary effects of leases and mines on lynx are probably related to the potential for plowed roads to provide access for lynx competitors, particularly coyotes.

Summary

Environmentally, application of the social and economic mitigation measures to the prohibition alternatives would diminish the potential beneficial effects of a prohibition on road construction and reconstruction, given the greater amount of area disturbed and the kinds of activities enabled. Depending on a variety of factors, leasable mining activities supported by road access could potentially have detrimental effects to aquatic and terrestrial habitats and species. However, at current levels of activity and given the application of best management practices, the potential extent of these activities and their impacts do not appear to be widespread and it is unlikely that most effects from individual projects would extend much beyond local levels. However, the effects associated with these roads and the activities enabled would measurably contribute to the overall level of cumulative adverse effects to biodiversity associated with loss of habitat quality and quantity, increased levels of habitat fragmentation, and overall levels of disturbance in these areas, contrary to meeting the stated purpose and need for this project. If this exception is included as part of the final rule, decisions on whether to permit such activities, and if so, what environmental mitigation measures would be required, would be made using current planning and decision-making processes. Overall, even with application of these measures, Alternatives 2, 3, and 4 would still provide some important benefits relative to conservation of biological diversity.

4.4 Cumulative Effects

There are currently over 1,300 TEP species in the United States. National Forest System lands (192 million acres) provide habitat for a large number (419 estimated) of these TEP species. The 58.5 million acres of inventoried roadless areas provide habitat for an estimated 240 TEP species. It is conceivable that the number of species in the United States that merit listing early in the 21st century may be 2 or 3 times that of the number currently listed (Wisdom and others 2000). Currently, there are over 2,900 Forest Service designated sensitive species, with about two-thirds of those likely to have habitat within or be affected by inventoried roadless areas. Since National Forest System lands, including inventoried roadless areas, provide habitat for a significant number of species, the impacts of activities on NFS lands is expected to have a cumulative effect on these species at a national scale.

The Forest Service has two other recent or ongoing rulemaking efforts related to the Roadless Area Conservation Project: the new Planning Regulations (36 CFR 219) and the Roads Policy, expected to be finalized soon. These two rules, combined with any of the action alternatives in the Roadless Area Conservation Project ,would provide a consistent strategy for managing National Forest System lands that would help ensure long-term ecological sustainability, maintenance of species viability, and conservation of native biological diversity within these important public resources. Key elements of the proposed Roads Policy and this rule would be complementary to the sustainability, collaboration, science and other requirements of the new Planning Regulations. These rules in combination would cumulatively benefit TEPS species by enhancing the consideration of species conservation during planning and management efforts.

The Forest Service has several ongoing broad-scale forest plan amendment efforts, including the Interior Columbia Basin Ecosystem Management Project and the Sierra Nevada Framework. In addition, the Northwest Forest Plan is currently being implemented in the Pacific Northwest and northern California. These three projects would result in changes to on-the ground management by stipulating standards and guidelines for management of NFS resources. Each of these planning efforts when combined with the Roadless Conservation Project could cumulatively benefit TEPS species by protecting watersheds, promoting high water quality, and increasing conservation of terrestrial and aquatic species habitats. Many other forest plan revisions are either underway or will be undertaken within the next five years, which would provide additional cumulative benefits when combined with the effects of these three proposed rules.

There are a number of species-specific conservation strategies and recovery plans that have been developed to direct management for the protection and conservation of threatened and endangered species. For example, the Interagency Lynx Conservation Assessment and Strategy (USDA and others 2000a) was developed to provide a consistent and effective approach to conservation of the Canada lynx on federal lands in the conterminous United States. The Grizzly Bear Recovery Plan (USDI 1993) identifies actions necessary for the conservation and recovery of grizzly bears. These conservation strategies, combined with the proposed road management and planning rules, and the roadless area conservation project, would provide additional conservation benefits to TEPS species.

Since National Forest System lands, including inventoried roadless areas, provide habitat for so many TEPS species, the anticipated beneficial effects of the Roadless Area Conservation Project in combination with the other Forest planning and broad scale assessments could cumulatively benefit TEPS species at national, regional and local scales. All of the action alternatives would have the potential for important cumulative beneficial effects to conservation of native biological diversity and species viability by reducing substantial causes of habitat loss and degradation. Biological strongholds and other important habitat for terrestrial and aquatic TEPS species would receive substantial cumulative protection against future disturbance, considering the level of protection currently provided by existing policy, conservation strategies, forest plans, and other protected land designations.

Based on current literature (Flather and others 1999; Noss and Cooperrider 1994; Stein and others 2000) and data from Forest Service regions, it is possible to conclude that with or without conservation of inventoried roadless areas, biodiversity is at an increased risk of adverse cumulative effects from increased population growth and associated land uses, land conversions, and nonnative species invasions. Conservation of inventoried roadless areas provided by the alternatives, however, may lessen this risk at least in the short term (20 years) by reducing the level of potential adverse impacts on inventoried roadless areas, some of the last relatively undisturbed large blocks of land outside of designated Wilderness.

The action alternatives would increase conservation of inventoried roadless areas and therefore, could have beneficial effects on biodiversity conservation at the local, regional, National Forest System, and national levels. There would be similar incremental beneficial effects on biodiversity conservation when any one of the prohibition alternatives is combined with the past, present, and reasonably foreseeable land uses and conversions, laws, regulations, policies, and nonnative species invasions. The local, regional, and national cumulative beneficial effects to TEPS species and biodiversity could include:

- Conserving and protecting large contiguous blocks of habitat that provide habitat connectivity and biological strongholds for a variety of terrestrial and aquatic plant and animal species including TEPS species.
- Providing important local and regional components of conservation strategies for protection and recovery of listed TEPS species.
- Providing increased assurances that biological diversity would be conserved at a landscape level, including increased area of ecoregions protected, improved elevational distribution of protected areas, decreased risk of additional timber harvest and road caused fragmentation, and maintenance and restoration of some natural disturbance processes.
- Providing increased assurance that biodiversity would be supported within inventoried roadless areas including the maintenance of native plant and animal communities where nonnative species are currently rare, uncommon, or absent.

The value of inventoried roadless areas in conserving biodiversity is likely to increase as habitat loss and habitat degradation increase in scope and magnitude. With these increasing trends, the importance of roadless area conservation and other laws, regulations, and policies in the management of biodiversity is also likely to increase.

The action alternatives when considered alone may not be as important on a national level as when considered in combination with other land conservation laws, policies, and strategies. For example, many inventoried roadless areas in combination with Wilderness Areas, Nature Conservancy Preserves, some National Forest System land allocations, national parks, or conservation easements provide large contiguous habitat blocks with national significance for biodiversity conservation.

The beneficial effects of the prohibitions may be most noticeable at an inventoried roadless area, regional, or NFS level, but there are also beneficial effects for the United States. For instance, in the Southeastern United States, because of the magnitude of land use and land conversion, and the relatively small size of existing protected areas, inventoried roadless areas are especially important for species like the Louisiana black bear. Similarly, inventoried roadless areas in some areas of the Forest Service Intermountain and Northern regions of the Western United States, contribute to habitat connectivity, which is an important feature of northern Rocky Mountain ecosystems for species like the grizzly bear, wolf, and lynx. In these examples, the local protection and conservation of threatened or endangered species habitat are also important in terms of conserving biodiversity at a national level.

Whether the cumulative beneficial effects of the prohibitions and other past, present and reasonably foreseeable actions would fully offset predicted future increases in land uses, land conversions, and nonnative species invasions is difficult to assess. Yet, it is possible to conclude that without the prohibitions, there would likely be an increased risk of adverse cumulative effects to biodiversity. When compared to the No Action Alternative, the prohibition action alternatives would help conserve management options over the next 20 or more years, providing society with additional time to make reasoned choices on biodiversity conservation.

At some point in the future, projected habitat loss and degradation from the direct and indirect effects of increasing population growth could potentially surpass the contribution of inventoried roadless areas to biodiversity conservation. Under this scenario, habitat loss and the loss of viable plant and animal populations may be of a magnitude such that the beneficial effects of the prohibitions and other laws, regulations, and policies relative to biodiversity conservation may be lost or overwhelmed. Even in these circumstances, inventoried roadless areas would still likely convey some beneficial effects relative to conservation of individual TEPS species locally, regionally, and nationally.

4.5 Summary of determinations

All of the alternative combinations analyzed for this biological evaluation were found to have the same overall determination of potential effects to TEPS species:

- *May affect, but not likely to adversely affect threatened or endangered species or adversely modify designated critical habitat, and not likely to jeopardize proposed species or adversely modify proposed critical habitat. May beneficially affect threatened, endangered, and proposed species and critical habitat.*

- *May impact individuals, but not likely to cause a trend towards federal listing or a loss of viability for any sensitive species. May beneficially affect sensitive species and their habitat.*

As described in other sections of this document, these determinations were based on:

- Regional biologist review of species lists to identify potential adverse effects.
- Review of current scientific research on potential adverse and beneficial effects of roads and timber harvest on TEPS and other species.
- Recognition that action alternatives for this proposal would not directly authorize any management activities involving ground disturbance or landscape alteration. (i.e. decision would address what to prohibit, not what to authorize).
- Analyis of data collected from each forest indicating that road construction within inventoried roadless areas is not essential for TEPS species or habitat management.
- Evaluation showing that the only potential for adverse effects to some sensitive species would stem from the prohibition on timber harvest under Alternative 4.
- Recognition that some types of past timber harvest and the effectiveness of past wildfire suppression have caused significant ecological shifts in vegetation, fuel loading, and fire regimes in some areas.
- Analysis conducted by the fire specialist on the EIS team showing minimal landscape level differences between prohibition alternatives, relative to the

likelihood of timber harvest providing significant reduction in catastrophic fire risk in inventoried roadless areas, at projected harvest levels.

- Review of current scientific literature revealing a lack of research addressing the feasibility, effectiveness, and ecological legacies of landscape-level fuels reduction efforts.
- Review of current scientific literature showing that many terrestrial and aquatic species evolved under the influence of recurrent fire and stand replacing events, and are dependent on these types of events for development and maintenance of important habitat components.
- Recognition of the exception under Alternative 4 for timber harvest needed for recovery or conservation of TEP species, provisional on the concurrence of the applicable federal agency with ESA oversight responsibilities.
- Recognition that Alternative 4, which would preclude use of timber harvest for stand enhancement, successional stage management, or fuels reduction which may be desirable for some sensitive species, could pose an elevated risk for individuals within some sensitive species populations, but not to entire populations or species.

All of the alternatives analyzed would have the potential for important beneficial impacts to TEPS species, by lowering the risks of future habitat degradation and disturbance, and conserving existing biological strongholds. The degree of beneficial effects would vary somewhat by alternative.

5.0 Consultation to Date and Contributors

Informal consultation and conferencing on the proposed Forest Service Roadless Conservation project have occurred through frequent discussions among Forest service, U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) biologists at the national level. Informal meetings and telephone calls between biologists from the Forest Service Environmental Impact Statement (EIS) team, and representatives from the USFWS and NMFS have occurred throughout the planning process. In addition, an Interagency Team that includes representatives from these agencies was convened early in the planning process as a steering committee to provide review, edits, advice and oversight to the project. The USFWS and NMFS assigned representatives to the EIS team to assist with development of the Roadless Conservation Project EIS and the consultation process.

On February 10, 2000, the Forest Service sent a letter to the USFWS and NMFS requesting review and concurrence on a preliminary threatened, endangered, and proposed species list to be used for Endangered Species Act (ESA) Section 7(a)(2) consultation on the proposal. This letter also outlined the intent of the Forest Service to seek programmatic review of the conservation merits relative to TEPS species of both the prohibitions and the procedures components of the project under section 7(a)(1) of the ESA. It documented discussions with both agencies that a Biological Assessment (BA) is not required given that the proposed action is not a "major construction activity"; and included a preliminary list of candidate species to be used in conjunction with the TEPS species list for the purposes of programmatic review. The USFWS and NMFS responded in writing, concurring with the species lists, confirming that a BA is not required and acknowledging the intent to consult on the proposal as well as request programmatic review.

Letters were sent to USFWS and NMFS on July 31, 2000, requesting concurrence with the determination in the biological evaluation for threatened, endangered and proposed species, that the alternatives analyzed may affect, but are not likely to adversely affect threatened or endangered species or adversely modify designated critical habitat; and are not likely to jeopardize proposed species or adversely modify proposed critical habitat; and that these alternatives may beneficially affect threatened, endangered, and proposed species and critical habitat.

The following individuals from NMFS and USFWS were actively involved in informal discussions or provided correspondence during the Roadless Area Conservation Project planning:

Alice Berg, NMFS, Biologist
Donna Brewer, NMFS, Fishery Biologist
Craig Johnson, NMFS, Fishery Biologist
John Fay, USFWS, Biologist

Other Forest Service biologists involved in the evaluation and the development of the species lists included regional threatened and endangered species (TES) program leaders and their assistants, regional fisheries biologists, wildlife biologists, botanists, ecologists, and roadless area project coordinators, and forest fish and wildlife biologists and botanists.

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Roadless Database References

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Attachments

The following attachments are included in this section:

Attachment TEP1. Summary of Threatened, Endangered, and Proposed Species

Attachment TEP2. Summary of Candidate Species

Attachment TEP3. Threatened, Endangered and Proposed Species: National and Regional Statistics for NFS Lands and Inventoried Roadless Areas

Attachment TEP4. Threatened, Endangered and Proposed Species: National Forest Statistics for NFS Lands and Inventoried Roadless Areas

Attachment TEP5. Threatened, Endangered and Proposed Species: National and Regional Statistics by Species Groups for NFS Lands and Inventoried Roadless Areas

Attachment TEP6. Threatened, Endangered and Proposed Species: National Master List by Region, Species Group and National Forest for NFS Lands and Inventoried Roadless Areas

Attachment S1. Summary of Sensitive Species

Attachment S2. Sensitive Species: National Master List by Region and Species Group for NFS Lands and Inventoried Roadless Areas

Attachment S3. Sensitive Species: National and Regional Statistics by Species Groups for NFS Lands and Inventoried Roadless Areas